NUCLEAR SCIENCE ABSTRACTS

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NUCLEAR SCIENCE ABSTRACTS

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BIOLOGY AND MEDICINE

1445

Tennessee Valley Authority
A SUMMARY OF FINDINGS OF THE ECOLOGICAL SURVEY OF WHITE OAK CREEK, ROANE COUNTY, TENNESSEE, 1950-1953. Louis A. Krumholz. Oct. 1954. 54p. Contract AT(40-1)-221. (ORO-132)

White Oak Creek receives the waste effluent from the Oak Ridge National Laboratory. This waste effluent consists of a heterogeneous mixture of chemical wastes resulting from laboratory, pilot-plant, and full-scale operations. Some of these wastes are radioactive and some are not. Part of the radioactivity is due to fission products, uranium, and transuranic elements, and part to induced radioactivity from the processing of various materials in isotope preparation. In addition to these industrial wastes, there is effluent from sewage treated by sedimentation and chlorination. White Oak Lake is an impoundment of the waters of White Oak Creek designed to serve as a delay in the water stream between the Laboratory and the Clinch River. Findings are summarized from an ecological survey of White Oak Creek carried out from 1950 to 1953. Included in the survey were studies on botany, limnology, and vertebrate organisms collected in the region. (C.H.)

RADIATION EFFECTS

1446

Radiation Lab., Univ. of Calif., Berkeley
SERUM LIPOPROTEINS AS AN INDICATION OF SURVIVAL TIME IN THE X-IRRADIATED RABBIT. Thomas L. Hayes and John E. Hewitt. [1954] 19p. Contract W-7405-eng-48. (UCRL-2790)

A detailed analysis of the hyperlipoproteinemia of the x-irradiated rabbit is presented. Increases of certain classes of lipoproteins at 24 hours postirradiation are correlated with subsequent time of death. (auth)

1447

Naval Radiological Defense Lab.
ENLARGEMENT OF THE LIVER IN SPRAGUE-DAWLEY RATS FOLLOWING WHOLE-BODY X IRRADIATION. Helen Supplee, E. O. Weinman, and C[ecil] Entenman. Oct. 12, 1954. 26p. (USNRDL-TR-18)

Previous experiments with x irradiation had indicated that significant increases occurred in the weight of the liver. In the present paper these observations are confirmed. A significant increase in liver mass of rats may occur as early as 6 hr after x irradiation with a dose as low as 200 r. Water, liquid and glycogen contribute to the increase in mass. The most striking change is in the glycogen content. (auth)

1448

INFLUENCE OF ANOXIA UPON HEMATOPOIETIC CELLS OF TADPOLES EXPOSED TO X-IRRADIATION OF COLCHICINE. Bennet M. Allen, Ole Arne Schjeide, and Ronald Piccirillo (Univ. of California School of Medicine, Los Angeles). J. Cellular Comp. Physiol. 44, 318-22(1954) Oct.

Anoxia was found to suppress cell division and thereby retard x irradiation damage to the hematopoietic tissues of tadpoles of Rana catesbiana. Results indicate that mitosis is slowed in rough proportion to the duration of partial anoxia in the tadpole. Data on x radiation inhibition and colchicine arrest are compared. (C.H.)

1449

THE EFFECTS OF TUMOR GROWTH, X-RADIATION, AND 8-AZAGUANINE ON THE INCORPORATION OF ADENINE INTO NUCLEIC ACIDS OF MICE. James Leong Way, H. George Mandel, and Paul K. Smith (George Washington Univ. School of Medicine, Washington, D. C.). Cancer Research 14, 812-16(1954) Dec.

Adenine-8-C^{14} was synthesized from 4,5,6-triaminopyrimidine and sodium C^{14}-formate and was injected intraperitioneally into CAF$_1$ mice. The effects of Sarcoma 37, x radiation, and the simultaneous administration of 8-azaguanine on the incorporation of adenine-C^{14} into the nucleic acids of tissues from the mice were evaluated. In tumor-bearing mice a high preferential incorporation into the liver PNA purines and a lesser but similar incorporation into the tumor PNA and DNA fractions were observed. The relative specific activities of liver DNA purines were higher, and the PNA purines were slightly higher in tumor-bearing than in control mice. X radiation produced a decreased incorporation into liver DNA purines and a slightly increased incorporation into the PNA purines of the livers of normal as well as tumor-bearing mice. X radiation produced a slightly increased incorporation into the tumor PNA but no appreciable change in the tumor PNA but no appreciable change in the tumor DNA purines of tumor-bearing mice. The simultaneous administration of 8-azaguanine and adenine-C^{14} produced no effect on the pattern of incorporation of adenine into the PNA or DNA. (auth)

1450

THE MECHANISM OF INDUCTION AND THE CHARACTERISTICS OF PITUITARY TUMORS INDUCED BY THYROIDECTOMY. Jacob Furth, James Norman Dent, William T. Burnett, Jr., and Evelyn L. Gadsden (Children's Cancer Research Foundation, Boston, Mass., and Oak Ridge National Lab., Tenn.). J. Clin. Endocrinol. and Metabolism 15, 81-97(1955) Jan.

Observations are summarized from studies on mice which led to the conclusion that sustained deficiency of thyroid hormone gives rise to thyrotropic pituitary tumors, whether the thyroid deficiency be brought about by ionizing radiation or by other agents. (C.H.)

1451

COMPARATIVE EFFECTS OF X-RAY AND ULTRAVIOLET RADIATION ON THE DIFFERENTIATED CHROMOSOMES OF THE TOMATO. Donald W. Barton (Univ. of Missouri, Columbia). Cytologia (Tokyo) 19, Nos.2-3, 157-75(1954). (In English)

Cytological analysis at pachytene of F$_1$ tomato plants following x-ray and ultraviolet pollen treatment has established that there is a higher proportion of deficiencies to translocations following ultraviolet treatment than following x-ray treatment. These results are in agreement with previously reported research on maize. In contrast with previous reports from maize, both x-ray and ultraviolet treatment produced both terminal and interstitial deficiencies in tomato chromosomes. It is suggested that the high proportion of interstitial to terminal deficiencies results from the high selective effect imposed by proximally-localized breakage resulting in long haplo-lethal deficiencies. Chromosome breakage, as observed in F$_1$ plants, was highly localized in the chromatic regions of the chromosomes following both x-ray and ultraviolet treatment. A consideration of the cyclic behavior of the chromatic and achromatic regions leads to the proposition that greater chromatin volume at the time of applied radiation results in a greater frequency of breakage in the chromatic regions than in the achromatic regions. The cytological behavior of a number of translocations and deficiencies is discussed. Of particular interest is the cytological behavior of two deficiency-translocations produced by ultraviolet radiation. One of these is accompanied by an iso-chromosome which exhibits normal centromeric activity with a submicroscopic centromere. In the other case, rebreakage of a translocated achromatic chromosome segment following chiasma formation provided evidence of the cycly of the achromatic regions through meiotic stages. (auth)

RADIATION HAZARDS AND PROTECTION

1452

PROTECTION AGAINST RADIATIONS FROM RADIUM, COBALT-60, AND CESIUM-137. Natl. Bur. Standards Handbook 54, Sept. 1, 1954. 60p. $0.25 (GPO).

1453

PERMISSIBLE DOSE FROM EXTERNAL SOURCES OF IONIZING RADIATION. Natl. Bur. Standards Handbook 59, Sept. 24, 1954. 79p. $0.30 (GPO).

1454

PROTECTIVE EFFECT OF d,l-α-OCTADECYLGLYCEROLETHER IN MICE GIVEN TOTAL BODY X-IRRADIATION. T. Edlund (Univ. of Uppsala, Sweden). Nature 174, 1102 (1954) Dec. 11.

Batyl alcohol was found to have a beneficial therapeutic effect on irradiation injuries in mice. (C.H.)

1455

ALKOXYGLYCEROLS IN THE TREATMENT OF LEUKOPAENIA CAUSED BY IRRADIATION. Astrid Brohult (Radiumhemmet, Stockholm, Sweden) and John Holmberg (Forskningslaboratoriet LKB, Appelviken, Sweden). Nature 174, 1102-3(1954) Dec. 11.

Treatment with alkoxygerols administered by mouth proved effective in raising the white blood count of patients suffering from radioinduced leukopenia. (C.H.)

RADIOGRAPHY

1456

Radiation Lab., Univ. of Calif., Berkeley

AN AUTOMATIC EXPOSURE CONTROLLER FOR ROENTGENOGRAPHIC EXAMINATION. William E. Nolan, George F. Schrader, and Gordon M. Fitzgerald. Nov. 4, 1954. 12p. Contract W-7405-eng-48. (UCRL-2774)

An automatic timing device capable of automatically controlling the density of roentgenographic exposures is described. The instrument has been used only in the field of oral roentgenography; however, its principle has many applications in the field of medical as well as industrial and oral roentgenography. (auth)

RADIOTHERAPY

1457

TIME AND SITE STUDY FOR OPTIMUM LYMPH NODE CONCENTRATION OF RADIOGOLD FOLLOWING INTRABRONCHIAL INJECTION. Harold F. Berg, William M. Christopherson, and J. Ray Bryant (Univ. of Louisville School of Medicine, Kentucky). Cancer Research 14, 775-9(1954) Dec.

Colloidal Au^{198} was injected into the bronchial mucosa of dogs in an attempt to determine the rapidity of concentration within the regional lymph nodes and the site of injection for optimum concentration within the nodes. Specimens of the regional lymph nodes and viscera were measured for radioactivity. Histologic sections and autoradiographs were examined and compared with those from a group of animals receiving a similar dosage of Au^{198} and sacrificed in from 1 to 5 weeks. Colloidal radiogold of this particle size concentrated within the regional lymph nodes well within the effective activity range of the isotope. Radioactivity was concentrated in the lymph nodes and was not distributed in any appreciable amount to other organs. The most effective site of injection within the bronchial tree was found to be the most dependent accessible site within the bronchus. Radiation necrosis within the lymph nodes had a patchy distribution when small doses of Au^{198} were used. This distribution was confirmed by autoradiographs. (auth)

1458

ROENTGEN, RADIUM AND RADIOISOTOPE THERAPY. A. J. Delario (St. Joseph Hospital, Paterson, N. J.). Philadelphia, Lea and Febiger, 1953. 371p.

Biological reactions to radiation, the diseases that are benefited by this form of treatment, treatment methods and dosages, and the physical aspects of radiation are discussed thoroughly yet briefly from a physician's point of view. (C.H.)

1459

ANIMAL DISTRIBUTION OF COLLOIDS OF Au^{198}, P^{32}, and Y^{90}. AN IMPROVED METHOD OF TISSUE ASSAY FOR RADIOACTIVITY. T. N. Lahr, Robert Olsen, G. I. Gleason, and D. L. Tabern (Abbott Labs., North Chicago, Ill. and Oak Ridge, Tenn.). J. Lab. Clin. Med. 45, 66-80(1955) Jan.

A quantitative comparison is presented of three types of chromic phosphate colloids, and of several colloids prepared from Au^{198} and Y^{90}. The data indicate excellent cavitary retention in the case of Type G CrPO$_4$, and excellent retention of Y^{90}, as the phosphate. In view of the established clinical safety of Au^{198} colloid (Aurcoloid), several of these others are undergoing clinical evaluation by groups with experience in this field. Data regarding cavitary distribution and clinical effectiveness can be secured only on suitable clinical material. Also presented is a much simplified method for tissue assays, involving homogenization of whole organs, solution of aliquots at room temperature in Formamide, and either beta counting at infinite thickness, or, where possible, gamma counting in a suitable well-type scintillation unit. (auth)

1460

IODINATED COMPOUNDS IN THE SERUM, DISAPPEARANCE OF RADIOACTIVE IODINE FROM THE THYROID, AND CLINICAL RESPONSE IN PATIENTS TREATED WITH RADIOACTIVE IODINE. Richard S. Benua and Brown M. Dobyns (Western Reserve Univ. School of Medicine and Cleveland City Hospital, Cleveland, Ohio). J. Clin. Endocrinol. and Metabolism 15, 118-30(1955) Jan.

Iodinated compounds which appear in the serum after the administration of a therapeutic dose of I^{131} have been isolated by chromatographic fractionations, following 34 radioiodine treatments for hyperthyroidism or thyroid cancer. The relationships between the time of appearance of these compounds, the clinical response of the patient, the amount of radiation delivered to the thyroid, and the rate of disappearance of radioactivity from the gland have been discussed. Triiodothyronine was detected in the serum in 19 patients, monoiodotyrosine in 14 and diiodotyrosine in 6. Evidence is presented to suggest that the presence of triiodothyronine is related to the degree of thyrotoxicosis and not to the effect of radiation. The presence of diiodotyrosine appeared to be the result of radiation damage to the thyroid gland. Following radioiodine therapy, a change toward an increasing rate of loss of I^{131} from the thyroid may be an indication of radiation effect. (auth)

TOXICOLOGY STUDIES

1461

A SURVEY OF EFFECTS OF CHEMICALS ON DIVISION AND GROWTH OF YEAST AND EXCHERICHIA COLI. L. E. Loveless, Edward Spoerl, and T. H. Weisman (Mound Lab., Miamisburg, Ohio). J. Bacteriol. 68, 637-44(1954) Dec.

Chemicals which were tested as cell-division inhibitors for Saccharomyces cerevisiae and Escherichia coli are grouped as those which were without effect on either division or growth of the test organisms, those which inhibited growth of either organism without affecting division, those which inhibited both growth and division of yeast, and those which selectively inhibited division without appreciably reducing culture growth. Only methyl-bis-(β-chloroethyl) amine and triethylenemelamine specifically inhibited cell-division for yeast, while cell-division in E. coli was inhibited by these two compounds and also by acriflavine, diazouracil, diethyl sulfate, dimethyl sulfate, ethylenimine, 5-nitro-7-hydroxybenzotriazole, and β-propiolactone. It is suggested that the specific inhibition of cell-division by such compounds is due to their ability to produce carbonium ions in solution. (auth)

TRACER APPLICATIONS

1462

Atomic Energy Project, Univ. of Calif., Los Angeles
THE RADIOACTIVE (I^{131}-TAGGED) ROSE BENGAL UPTAKE-EXCRETION TEST FOR LIVER FUNCTION USING EXTERNAL GAMMA RAY SCINTILLATION COUNTING TECHNIQUES. George V. Taplin, Orsell M. Meredith, Jr., and Harold Kade. Dec. 17, 1954. 29p. Contract AT-04-1-GEN-12. (UCLA-319)

Laboratory studies in rabbits indicate the potential clinical applicability, high sensitivity, and relative safety of the radioactive Rose Bengal liver uptake-excretion test for determining the presence of liver and biliary tract disease. The techniques employed in rabbits and the modifications required for application in clinical medicine are described. Preliminary clinical results demonstrate that patients with some of the common diseases of the liver have fairly typical uptake-excretion patterns which are readily distinguishable from those recorded in normal individuals. Need for additional clinical investigation is stressed, and some possible advantages from further modifications in technical procedures are suggested. (auth)

1463

THYROID FUNCTION ASSAY WITH RADIOIODINE. I. PHYSICAL BASIS OF STUDY OF EARLY PHASE OF IODINE METABOLISM AND IODINE UPTAKE. T. H. Oddie, I. Meschan, and J. Wortham (Univ. of Arkansas, Little Rock). J. Clin. Invest. 34, 95-105(1955) Jan.

The metabolism of iodide in the human body is discussed on a mathematical basis with the object of improving the accuracy of diagnostic tests of thyroid conditions with radioiodine. Allowance is made for changes in the iodide space and the effective volume of neck tissues observed by external gamma ray counting at various times after the administration of the test dose. After testing the resulting equations by experiments on a series of patients, the mean test results are combined with data deduced from the publications of other workers to give tabulated information suitable for practical use. (auth)

1464

THYROID FUNCTION ASSAY WITH RADIOIODINE. II. ROUTINE CALCULATION OF THYROIDAL AND RENAL RATE FACTORS. T. H. Oddie, I. Meschan, and J. Wortham (Univ. of Arkansas, Little Rock.). J. Clin Invest. 34, 106-14(1955) Jan.

Routine methods are developed for calculating thyroidal uptake and renal excretion rate factors from measured fractions of the dose of radioiodine observed at an early time t after administration. Charts are included, for selected times t of 1,4, and 24 hours, giving the rate factors directly from the experimental observations when uptake readings are made with good collimation to keep the extrathyroidal neck tissue contribution low. Under these conditions such contribution is taken as a mean value for all patients and an uptake study normally requires only one observation over the thyroid gland and one urine assay. (auth)

1465

AN IMPROVED METHOD FOR SIMULTANEOUS DETERMINATION OF EXCHANGEABLE BODY SODIUM AND POTASSIUM. C. V. Robinson, Walter L. Arons, and A. K. Solomon (Harvard Medical School, Peter Bent Brigham Hospital, and New England Center Hospital, Cambridge, Mass.). J. Clin. Invest. 34, 134-40(1955) Jan.

An improved method for the simultaneous determination of exchangeable body sodium and potassium, utilizing a differential counting technique is described. This technique makes it possible to measure the individual radioactivites of Na^{24} and K^{42} in solutions containing these isotopes without first separating them, as was heretofore necessary. The accuracy of the measurement of exchangeable body sodium and potassium by this method has been demonstrated by the satisfactory agreement obtained between single and simultaneously determined values on each of seven normal, male subjects. The present procedure has been found to be considerably less complex and time-consuming than those previously used. (auth)

CHEMISTRY

1466

Naval Research Lab.
THERMAL AND RELATED PHYSICAL PROPERTIES OF MOLTEN MATERIALS. PROGRESS REPORT NO. 11 [FOR] PERIOD AUGUST 1—OCTOBER 31, 1954. B. E. Walker, C[urtis] T. Ewing, and D. D. Williams. Dec. 17, 1954. 9p. (NRL-Memo-393)

Heat content measurements were made on Monel salt containers from 100 to 900°C and the fused salt from 100 to 580°C with heat capacity values of the salt from 64 to 354°C. The reactions of fused NaOH with Monel and Cu are discussed, and equations are given. Equations for the reaction of fused NaOH with Fe, Ti, Ta, Be, Mn, and Cr are also given. (For preceding period see NRL-Memo-387.) (J.A.G.)

1467

Metals Research Lab., Carnegie Inst. of Tech.
ELECTROCHEMICAL STUDIES OF NON-AQUEOUS MELTS. QUARTERLY PROGRESS REPORT FOR PERIOD ENDING OCTOBER 1, 1954. R. F. Mehl and G. Derge. Dec. 1954. 16p. Contract AT(30-1)-1024. (NYO-6616)

Data are presented from studies of the electrical conductivity of liquid Ag_2S, Cd_3As_2, copper arsenides, and SnAs; measurement of the self-diffusion coefficients of Fe in molten FeS and Cu in molten Cu_2S; and the electrolysis of molten silicate slags. (For preceding period see NYO-3699.) (C.H.)

1468

STUDIES ON VANADIUM OXIDES. I. PHASE ANALYSIS. Georg Andersson (Univ. of Uppsala, Sweden). Acta Chem. Scand. 8, No. 9, 1599-1606(1954).

The phase relations in the composition range VO to $VO_{2.50}$ of the vanadium—oxygen system have been investigated. Phases of the following (approximate) compositions were found to exist at temperatures between 650 to 1,000°C: VO (homogeneous within the range $VO_{0.75}$ to $VO_{1.20}$), $VO_{1.50}$, $^*VO_{1.67}$, $^*VO_{1.75}$, $^*VO_{1.80}$, $^*VO_{1.84}$, $^*VO_{1.86}$, $^*VO_{1.87}$, $VO_{2.00}$, $VO_{2.17}$ (at 650°C), and $VO_{2.50}$; the formulas marked with an asterisk represent previously unknown oxides. The $VO_{1.67}$ phase is monoclinic with the C centered unit cell dimensions: $a = 9.983$ A; $b = 5.031$ A; $c = 9.835$ A; $\beta = 138.80°$. The formula of this phase is probably V_3O_5, and the unit cell thus contains 4 V_3O_5. Powder photographs of the phases $VO_{1.75}$ to $VO_{2.00}$ suggest pronounced structural relationships to exist between these oxides. They may represent oxides belonging to a series with the general formula V_nO_{2n-1}. The VO_2 phase is monoclinic with the unit cell dimensions: $a = 5.743$ A; $b = 4.517$ A; $c = 5.375$ A; $\beta = 122.61°$. The observed reflections are in accordance to the space group $P2_1|c$. The unit cell contains 4 VO_2. The V_6O_{13} phase has been found to decompose into VO_2 and V_2O_5 at 700°C and higher temperatures. (auth)

1469

STUDIES ON THE HYDROLYSIS OF METAL IONS. VIII. METHODS FOR DEDUCING THE MECHANISM OF POLYNUCLEAR HYDROLYSIS REACTIONS. Sirkka Hietanen and Lars Gunnar Sillen (Royal Inst. of Tech., Stockholm, Sweden). Acta Chem. Scand. 8, No. 9, 1607-25(1954).

Experimental data for the hydrolysis of a metal ion Me^{z+} are conveniently summarized in the form of diagrams of $Z(\log h)_M$ and $\eta(\log h)_M$. (Z = average number of H^+ set free per Me, M = total concentration of Me, $m = [Me^{z+}]$, $h = [H^+]$, $\eta = \log M|m$.) The formation of polynuclear hydrolysis products may be treated formally as a complex formation between the hydrated Me^{z+} and the reactant "$-H^+$". The general methods for treating complexes between two reactants A and B have been transformed to this special case and applied to a number of systems. The general formula of the complexes is obtained from the spacing of the Z and η curves. Of the ions for which data are available in a wide concentration range, only two (Hg^{2+}, Tl^{3+}) give chiefly mononuclear hydrolysis products. A number of others (Fe^{3+}, Al^{3+}, Th^{4+}, UO_2^{2+}, etc.) give a set of parallel Z (or η) curves which implies that the complexes can be written in the general "core + links" form $Me((OH)_tMe)_n$ with t a constant = 2 or 3, and n variable. To find the details of the reaction mechanism, the experimental data for Fe^{3+} and Bi^{3+} have been treated by methods analogous to those in ABII. The data for Fe^{3+} indicate only one polynuclear complex, $Fe_2(OH)_2^{4+}$ while for Bi^{3+} a series of complexes $Bi(OBi)_n^{3+n}$ with n = 1, 2, 3, 4. . . . is indicated. The results are thus in agreement with the conclusions in part I and part VII of this series, and the equilibrium constants obtained with the new methods also agree rather well with those obtained earlier. (auth)

1470

STUDIES ON THE HYDROLYSIS OF METAL IONS. IX. THE HYDROLYSIS OF THE THORIUM ION, Th^{4+}. Sirkka Hietanen (Royal Inst. of Tech., Stockholm, Sweden). Acta Chem. Scand. 8, No. 9, 1626-42(1954).

The hydrolysis of the ion Th^{4+} in perchlorate medium at 25°C has been studied by electrometric titrations, using quinhydrone or hydrogen electrodes. Within the experimental accuracy, Z (the number of H^+ split off per Th), proved to be a function of the single variable $x = \log M - 3 \log h$ (M = total Th concentration, $h = [H^+]$). Hence it follows that all complexes formed in appreciable amounts can be written in the form $Th((OH)_3Th)_n^{4+n}$. From a direct analysis of the experimental $y(x)$ curve ($y = \frac{1}{3} Z$) it is concluded that complexes with a number of different n values are formed, and that no one n value predominates. No upper limit for n was found, and it was concluded that there must be n values considerably greater than 6. (auth)

1471

THE SYSTEM $CaO-CaF_2$. Tryggve Baak (Royal Inst. of Tech., Stockholm, Sweden). Acta Chem. Scand. 8, No. 9, 1727(1954)

The electric conductivities and phase diagrams of the system $CaO-CaF_2$ are reported. (J.E.D.)

1472

A FUNDAMENTAL STUDY OF THE MIXING OF PARTICULATE SOLIDS. Sherman S. Weidenbaum and Charles F. Bonilla (Columbia Univ., New York, N. Y.). Chem. Eng. Progr. 51, 27J-36J(1955) Jan.

The random nature of the operation of mixing particulate solids is described, and quantitative definitions of mixing, theoretical random equilibrium mixture, and degree of mixing are developed from a model of the operation of dry mixing which takes into account sampling procedure. These ideas are analyzed theoretically and illustrated with experimental data. The model is applied to the evaluation of mixing-system performance by a standard chi-square test and a new evaluation system based on chi-square. Degree of mixing is defined as the ratio of a theoretically calculated standard deviation for a random equilibrium mixture to the experimentally determined standard deviation among spot samples. A rate equation is proposed and is tested by mixing −40/ + 50 (U.S.) mesh sand and salt in a rotating horizontal cylinder. The equation holds for the initial mixing period. On longer mixing the central portion of the mixer develops a higher sand concentration than do the ends, a condition attributed to tumbling differences between the two kinds of particles and tumbling surface curvature near the ends. Different sampling methods are investigated, and the importance of complete reporting of sampling procedure is emphasized. (auth)

1473

NOTE ON THE CRYSTALLIZATION OF STILBENE FROM SOLUTIONS. Erika J. Miler. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 119-20(1953) Aug.

The crystallization of stilbene from ether by the successive evaporation of the solvent is reported. (L.T.W.)

1474

SOME THERMODYNAMIC RELATIONS AMONG THE VANADIUM OXIDES, AND THEIR RELATION TO THE OXIDATION STATE OF THE URANIUM ORES OF THE COLORADO PLATEAUS. Robert M. Garrels (U. S. Geological Survey, Washington, D. C.). Am. Mineralogist 38, 1251-65(1953) Nov.-Dec.

Fields of stability of several vanadium oxides in water solution at 25°C were calculated as functions of pH and oxidation potential. The bivalent oxide V_2O_2 is not expected under natural conditions; it should occur only at oxidation potentials below the breakdown potential of water. The oxide corresponding to the mineral montroseite, $V_2O_3 \cdot H_2O$ or VOOH, is predicted to coexist with common metal sulfides and to oxidize to V_2O_4 at about the same potential at which sulfide ion oxidizes to sulfate. Owing to difficulties entailed by the complex chemistry of V^{+5}, no attempt was made to calculate a boundary between V_2O_4 and a higher oxide. Diagrams showing the fields of stability of the various oxides were constructed, and contours showing the activities of the various vanadium ions have been superimposed. The stability fields of the vanadium oxides should be useful in deducing the environment of formation of the carnotite ores and the "blue-black" ores of the Colorado Plateaus. (auth)

ANALYTICAL PROCEDURES

1475

Mound Lab.

SPECTROCHEMICAL ANALYSIS OF BISMUTH. (INFORMATION REPORT) D. J. Hunt and G. Pish. Aug. 19, 1953. 20p. Contract AT-33-1-GEN-53. (MLM-891)

A spectrochemical method of analysis for low percentages of Ag, Cd, Pb, Sb, Sn, Zn, Cr, Fe, Mn, and Ni in Bi was developed using the line-width and intensity-ratio methods. The line-width method is especially useful in the higher concentration range. The intensity-ratio method appears best for the detection and analysis of small quantities of impurities. When Bi is used as the internal standard, as little as 0.5 ppm of Ag may be detected by the intensity-ratio method which uses the d-c arc for excitation. In general, the trace elements can be determined with a precision of better than 20%. (auth)

1476

Massachusetts Inst. of Tech.

THE HIGH FREQUENCY INDUCTION FURNACE IN THE DETERMINATION OF RADIOCARBON. A. M. Gaudin and Horacio E. Bergna. Apr. 1954. 9p. Contract AT(30-1)-956. (NYO-6259)

Assay of materials labeled with C^{14} commonly involves their oxidation to carbon dioxide, which is then measured directly in a Geiger counter or in a CO_2 ionization chamber. Alternatively the material may be converted to a solid, such as barium carbonate, before radioassay. It is suggested that the use of high-frequency induction heating in an oxygen atmosphere provides a fast, reliable method of oxidizing radioactive carbon to carbon dioxide, which can then be determined in the usual way. (auth)

1477

Radiation Lab., Univ. of Calif., Berkeley

THE CODETERMINATION OF IODINE-127, IODINE-131, AND ASTATINE-211 IN TISSUE. Patricia W. Durbin, Joseph G. Hamilton, and Marshall W. Parrott. Nov. 1954. 7p. Contract W-7405-eng-48. (UCRL-2792)

At^{211} and iodine, both stable and radioactive, in biological material in samples up to 50 grams can be determined by the procedure described. Tissue is digested with chromic acid, the mixture is reduced with oxalic acid, and the iodine and astatine are distilled quantitatively. At^{211} and I^{131} are then determined by radioactive assay and stable iodine by spectrophotometry. (auth)

GRAPHITE

1478

North American Aviation, Inc.

LOW TEMPERATURE THERMAL AND ELECTRICAL CONDUCTIVITY AND THERMOELECTRIC POWER OF GRAPHITE. Ned S. Rasor. Jan. 1, 1955. 23p. Contract AT-11-1-GEN-8. (NAA-SR-1061)

The thermal and electrical conductivity and the thermoelectric power of a natural graphite and several artificial graphite types have been measured from near the liquid-helium point to room temperature. The thermal conductivity was measured by a "self-heating" (Kohlrausch) method which permitted the use of small samples. The thermal conductivity was found to vary as the 2.7 power of the temperature in the low-temperature region. There appeared to be no correlation between the particle size and the temperature dependence in the low-temperature region, but there was evidence for a smaller dependence on temperature with a decrease in the degree of graphitization. The thermoelectric power at a given temperature was found to increase with a decrease in particle size. (auth)

LABORATORIES AND EQUIPMENT

1479

Mound Lab.

IMPROVEMENTS IN METHOD AND EQUIPMENT FOR DRAWING QUARTZ FIBERS. R. G. Olt. Jan. 29, 1952. 23p. Contract AT-33-GEN-53. (MLM-656)

Improvements in methods and equipment for drawing, transporting, and storing instrument-quality quartz fibers from 0.00008-inch to 0.040-inch diameter in lengths to 150 feet were made. Uniformity of fiber diameter improves with increase in drawing velocity from 5% variation at velocities below 1,000 inches per minute to 1% variation at 4,000 inches per minute. The improvements in both method and equipment for producing instrument-quality quartz fibers result from establishment of 100% conversion of quartz cane to fiber in a continuous and stable operation as the criterion for fiber drawing. The improvements in method include calculation of controllable factors. Establishment of the criterion of 100% conversion of quartz cane to fiber in a continuous and stable operation is the basis for calculation and control of conditions for producing any desired size of fiber. Volumetric fusing rates and diametral reduction ratios can be varied independently over a wide range for selection of desired drawing conditions. Nominal strengths of fibers drawn with the improved method and equipment are higher than those produced by earlier reel methods of drawing. The design of the drawing machine permits operation by one person for all fiber diameters. Arrangement of supports for drawing, transporting, and storage preserves maximum fiber properties. (auth)

1480

Radiation Lab., Univ. of Calif., Berkeley
CAPACITY FACTORS IN THE PERFORMANCE OF PERFORATED PLATE COLUMNS (thesis). Charles d'Ancona Hunt. Oct. 1954. 151p. Contract W-7405-eng-48. (UCRL-2696)

A study was made of factors affecting the vapor-handling capacity of perforated-plate liquid-vapor contacting columns. Vapor-phase pressure drop across plates, liquid entrainment upward from plate to plate, and plate stability were investigated as functions of operational and geometric column parameters. Gas-phase pressure drop across dry perforated plates was observed to follow functional relationships predicted from available information for single perforations. The presence of liquid on a plate increased the total pressure drop by the equivalent clear liquid head plus a small residue which is nearly constant for a given liquid. This residue was observed to be about 0.4 in. of water, independent of the properties of the flowing gas, with water on the plate, decreasing to less than 0.1 in. of water for hydrocarbons. Within the over-all uncertainty of the measurements the data were reasonably correlated by considering the residue to be the result of energy dissipated in bubble formation in the liquid. Entrainment was observed to be a function of column-gas velocity, independent of gas velocity in the perforations. Entrainment was also found to be proportional to the gas density and inversely proportional to the liquid density and liquid surface tension. For a given system, entrainment was observed to be proportional to approximately the third power of the gas velocity divided by the distance between the liquid surface and the plate above. The stability of perforated plates was observed to be adequate for many industrial and experimental applications, as also reported in recently published studies, but contrary to qualitative statements found in the earlier literature. Stability was found to increase with decreasing perforation diameter and decreasing total perforation area relative to column cross-sectional area, to increase with greater gas density, liquid surface tension and liquid wetting power, and to be virtually independent of liquid density and viscosity. Operating limits of vapor throughput are shown for some typical applications of perforated plate liquid-vapor contacting columns. (auth)

SEPARATION PROCEDURES

1481

Ames Lab.
FLOODING CHARACTERISTICS OF A PULSE EXTRACTION COLUMN. G[erhard] H. Beyer and R. B. Edwards. Dec. 10, 1954. 28p. Contract W-7405-eng-82. (ISC-553)

An investigation was made of flooding in a 1-in. diam. 10-plate pulse column, using the hexone—water system. Flooding was demonstrated to be caused either by inadequate pulsation or by excessive pulsation. An analysis of column operation led to the derivation of an equation for predicting conditions of inadequate pulsation and for establishing the amount of liquid recycled under any operating conditions. A simple, rapid procedure for the determination of flooding caused by excessive pulsation was developed. This type of flooding was found to be extremely sensitive to plate-wetting characteristics. (auth)

1482

CAPACITY AND LEAKAGE OF ION EXCHANGE COLUMNS. Morris Mindick (National Aluminate Corp., Chicago, Ill.). Ind. Eng. Chem. 47, 96-101(1955) Jan.

A practical method is described for evaluating and leakage of ion exchange columns without cyclic work. The stabilized operating capacity is determined from the value of the total exchangeable ions in the column at the breakthrough end point and the fraction of each exchangeable ion eluted from the exhausted column in regeneration. An equation is derived relating the operating capacity with these two experimental values. The simplest application of the method has been found in water and waste treatment. The causes and general types of leakage from ion exchange columns are described together with methods of predicting leakage using elution and equilibrium data. Equations are presented for leakage of monovalent and divalent ions and for weak acids and bases. (auth)

1483

THE SEPARATION OF SMALL AMOUNTS OF INORGANIC CATIONS BY CHROMATOGRAPHIC METHODS. I. INTRODUCTORY EXPERIMENTS WITH INACTIVE CATIONS. Göran Carleson (Univ. of Uppsala, Sweden). Acta Chem. Scand. 8, No. 9, 1673-92(1954).

Separations of divalent inorganic cations are studied on ion-exchange columns, employing aqueous solutions and partition-elution by means of organic solvents. A mixture of Ba, Ni, Mn, Co, Cu, Zn, and Bi is completely separated and collected into small fractions of elutriant. A new three-phase ion-exchange theory is introduced in order to explain the behavior during these elutions. It is in agreement with the experimental results and also with earlier published data. Paper strip separations are studied in n-butanol and different ketone mixtures with acids. Complete and reproducible separations of a wide combination of ions are obtained with methylpropyl ketone + HCl in less than 1 hour. (auth)

1484

THE SEPARATION OF SMALL AMOUNTS OF INORGANIC CATIONS BY CHROMATOGRAPHIC METHODS. II. AN AUTOMATIC SCANNER FOR RADIO PAPER CHROMATOGRAMS. Göran Carleson (Univ. of Uppsala, Sweden). Acta Chem. Scand. 8, No. 9, 1693-6(1954).

The construction of a sensitive and well resolving scanner of chromatograms is described, permitting the determination of R_F values for as little as $5 \cdot 10^{-7}$ mc Co^{60}. (auth)

1485

THE SEPARATION OF SMALL AMOUNTS OF INORGANIC CATIONS BY CHROMATOGRAPHIC METHODS. III. SPALLATION OF COPPER WITH 60 MEV PROTONS. Göran Carleson (Univ. of Uppsala, Sweden). Acta Chem. Scand. 8, No. 9, 1697-1700(1954).

Chromatographic paper strip technique is tested to separate the spallation products of copper. Complete separation of the whole group is obtained in about 3 to 4 hours, and a special monitor is not wanted. The yields of isotopes with half lives above 30 minutes can be determined. (auth)

SORPTION PHENOMENA

1486

Massachusetts Inst. of Tech.
ADSORPTION OF DODECYLAMMONIUM ACETATE ON HEMATITE AND ITS FLOTATION EFFECT. A. M. Gaudin and John G. Morrow. Mar. 1954. 41p. Contract AT(30-1)-956. (NYO-6257)

The adsorption of dodecylammonium acetate on hematite was measured for a wide range of concentrations of reagent in solution. Similar measurements for quartz have already been made. Contact angle measurements were then made on polished surfaces of hematite and of quartz immersed in aqueous dodecylammonium acetate solutions, and a functional relationship was sought between adsorption density at the mineral-solution interface and the contact angle. Finally, the surface tension of the aqueous amine acetate solutions was measured. These data were combined to give an evaluation of the work of adhesion for the three-phase system. (auth)

SYNTHESES

1487

Minnesota Mining and Manufacturing Co.
SYNTHETIC RUBBERS FROM CARBON–FLUORINE COMPOUNDS. [PART 1 OF PROGRESS REPORT FOR MAY 15, 1949 TO MAY 15, 1951]. W. H. Pearlson and N. W. Taylor. Oct. 1952. 110p. Contract AF53(038)-515. (WADC-TR-52-197(pt.1))

Exploratory investigation into the preparation and properties of fluorinated polymers is described. New polymeric compositions of matter have been synthesized and screened with respect to their potentialities as suitable elastomers for use under extreme conditions of temperature in contact with various fuels and oils. The esters of unsaturated hydrocarbon acids with 1,1-dihydroperfluoroalkyl alcohols represent the most promising class of monomers investigated so far; certain of their polymers have received considerable attention because of their rubbery properties and exceptional resistance to swelling by non-fluorinated solvents, although their low temperature flexibility will probably require extension by plasticization. Fluorinated condensation-type polymers such as polyesters and polyamides do not appear promising as elastomers but may have potentialities as fibres, films or structural plastics. Extensive structure versus property correlations are not attempted but it is concluded that either side-chain or backbone fluorine in polymeric structures promotes resistance to swelling by common solvents; the former does not appear to affect low temperature properties as adversely as sketal attachment. The possibility of constructing a better monomer than a fluoro-alkyl acrylate for development into a superier elastomer for specialized Air Force applications is still conceded for the field is relatively new and the number of known compounds small. (auth)

TRACER APPLICATIONS

1488

Atomic Energy Project, Univ. of Calif., Los Angeles
BIBLIOGRAPHY OF SYNTHESES WITH CARBON ISOTOPES. Judd C. Nevenzel, Richard F. Riley, David R. Howton and Gunther Steinberg, comps. Dec. 6, 1954. 175p. Contract AT-04-1-GEN-12. (UCLA-316)

References to the preparation of carbon-isotope-labeled compounds have been collected from the literature through 1952 and have been indexed according to formula and to author. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

1489

BERKELIUM AND CALIFORNIUM ISOTOPES PRODUCED IN NEUTRON IRRADIATION OF PLUTONIUM. L. B. Magnusson, M. H. Studier, P. R. Fields, C. M. Stevens, J. F. Mech, A. M. Friedman, H. Diamond, and J. R. Huizenga (Argonne National Lab., Lemont, Ill.). Phys. Rev. 96, 1576-82(1954) Dec. 15.

Californium isotopes of mass numbers 249, 250, 251, and 252 have been identified by mass spectrometric analyses of californium samples produced from neutron-irradiated plutonium. The half lives of Bk^{249}, Cf^{249}, Cf^{250}, Cf^{252}, and Cf^{253} are 290 ± 20 days, 470 ± 100 years, 10.0 ± 2.4 years, 2.2 ± 0.2 years, and 18 ± 3 days, respectively. The alpha-particle energies of the most prominent alpha peaks for Cf^{249}, Cf^{250}, and Cf^{252} are 5.81 ± 0.03, 6.033 ± 0.010, and 6.117 ± 0.010 Mev, respectively. The plot of alpha-particle energies vs. mass number for the isotopes of californium shows a break (i.e., the alpha energy of Cf^{252} is larger than the alpha energy of Cf^{250}) indicating an irregularity in the nuclear energy surface. The alpha spectra of Cf^{250} and Cf^{252} exhibit characteristic even-even nuclide fine structure peaks. The beta-particle energy of Bk^{249} is 80 ± 20 kev. The spontaneous fission half lives of Cf^{250} and Cf^{252} are $1.5 \pm 0.5 \times 10^4$ and 66 ± 10 years, respectively. Lower limits of 2×10^8 and 5×10^6 years have been placed on the partial spontaneous fission half lives of Bk^{249} and Cf^{249}. The pile (Materials Testing Reactor at Arco, Idaho) neutron capture cross sections of Bk^{249}, Cf^{250}, Cf^{251}, and Cf^{252} are 350, 1500, 3000, and 25 barns, respectively. (auth)

URANIUM AND URANIUM COMPOUNDS

1490

Mound Lab.
THE VISCOSITY OF URANYL SULFATE SOLUTIONS [FROM] 20° TO 90°. J. R. Heiks and J. S. Jegart. Feb. 22, 1954. Decl. June 23, 1954. 9p. Contract AT-33-1-GEN-53. (MLM-788(rev.))

The viscosity of aqueous uranyl sulfate solutions was determined over a concentration range of 0.176 to 2.865 molal and over a temperature range of 20 to 90°C. The viscosities in this investigation range from 0.349 centipoise at 90°C for the 0.176 molal solution to 8.53 centipoises at 20°C for the 2.865 molal solution. (auth)

ENGINEERING

AEROSOLS

1491

FILTRATION OF RADIOACTIVE AEROSOLS BY GLASS FIBERS. A. G. Blasewitz and B. F. Judson (Hanford Atomic Products Operation, Richland, Wash.). Chem. Eng. Progr. 51, 6J-11J(1955) Jan. (cf. NSA 5-4331, 4984)

The disposal of radioactive waste gases from the plant-scale processes at the Hanford Atomic Products Operation presents a problem that is of considerable importance in the plant operation. This paper is concerned with the efficient removal of the particulate matter suspended in the contaminated gas streams and represents the final report of an extensive investigation of the filtration properties of glass fibers undertaken to develop a filter unit having better performance characteristics than those of the initially installed sand filters. The program was divided into three primary studies consisting of: (1) the correlation of collection efficiency under start-up conditions with the superficial velocity of the gas stream and the bed depth and packing density of the various types of glass fibers, (2) the correlation of flow resistance under start-up conditions with the same variables, and (3) a study of the expected service life of glass fiber filters. The results of the development program led to the design of glass fiber filters capable of operating at a higher superficial air velocity than the plant sand filters and with a greater efficiency, a lower flow resistance, and a greater life expectancy. Such filters have been constructed and are presently employed at the Hanford Atomic Products Operation. The measured efficiency and flow resistance of the large-scale filters are in excellent agreement with the design data. The operating performance of the fixed-bed filters at this plant has been highly satisfactory. (auth)

HEAT TRANSFER AND FLUID FLOW

1492

Oak Ridge National Lab.
FREE CONVECTION IN FLUIDS HAVING A VOLUME HEAT SOURCE. (THEORETICAL LAMINAR FLOW ANALYSES FOR PIPE AND PARALLEL PLATE SYSTEMS). D. C. Hamilton, H. F. Poppendiek, R. F. Redmond, and L. D. Palmer. Dec. 3, 1954. 39p. Contract W-7405-eng-26. (ORNL-1769)

Theoretical laminar flow analyses are given for free convection in fluids having a uniform volume heat source and for both parallel plate and cylindrical pipe geometries. The solutions are intended to be valid in the central region (vertically) of channels having small diameters and large lengths; that is, the solutions do not apply to short systems or near the ends of long systems where the velocity and temperature profiles are not yet fully established. In addition, the solutions are restricted to systems in which the long axis is vertical and in which the walls are uniformly cooled by a forced flow coolant flowing vertically upward parallel to the long axis of the system. Solutions are obtained for the parallel plate geometry by two different techniques called "exact" and "approximate". In the "exact" method the differential equations for velocity and for temperature, which are interdependent in free convection systems, are solved simultaneously; in the "approximate" method the form of the velocity distribution is postulated and substituted in the temperature equation which is then integrated. Solutions by the two methods agree well in the range where the basic postulates are believed to be valid. The velocity and temperature structures are functions of two new dimensionless moduli. (auth)

1493

EXPERIMENTAL INVESTIGATION OF LOCAL HEAT EMISSION BY PLATES IN SUBSONIC TURBULENT AIR FLOW. B. S. Petukhov, A. A. Detlaf, and V. V. Kirillov. Zhur. Tekh. Fiz. 24, 1761-72(1954) Oct. (In Russian)

1494

VORTICITY AND DEFORMATION IN FLUID MECHANICS. A CONTRIBUTION TO THEIR KINEMATICAL PROPERTIES. Ion Carstoiu (Indiana Univ., Bloomington). J. Rational Mech. and Anal. 3, 691-712(1954) Nov.

The theory of vorticity is presented from a purely kinematical point of view. A generalization of Zorawski's criterion for material vortex-surfaces is given. An attempt is made to clear up the question of the existence of a potential for the acceleration. A finite equation for the deformation, analogous to Cauchy's formula for the vorticity, is obtained. Some applications of this formula are given. A geometrical interpretation of Appell's condition for the acceleration in a two-dimensional motion is given, along with some extensions for accelerational volumes in a three-dimensional space. The case of a rigid motion is studied in some detail. Material lines and surfaces are discussed. Some special problems on vorticity are presented with particular emphasis on a motion such that the vorticity or its magnitude is constant for each particle. (auth)

MATERIALS TESTING

1495

CREEP OF HIGH-PURITY NICKEL. William D. Jenkins, Thomas G. Digges, and Carl R. Johnson. J. Research Natl. Bur. Standards 53, 329-52(1954) Dec.

A study was made of the creep behavior in tension at 300°, 700°, 900°, and 1,200°F of initially annealed high-purity nickel. Discontinuous flow was observed in each of the three stages of creep, and it was affected by temperature, strain rate, and prior-strain history. The phenomenon of strain aging was especially prominent at 300°F as manifested by the attainment of an appreciable creep life in specimens stressed in excess of the tensile strength at this temperature. The experimental results are analyzed in terms of the past and present theories of deformation of metals. Strain hardening, recovery, and the initiation, propagation, and types of fractures obtained during creep are further evaluated by means of true-stress—true-strain and hardness data obtained at room temperature and by metallographic examination of the fractured specimens. (auth)

1496

THERMAL SHOCK TESTING. W. R. Buessem (Pennsylvania State Univ., State College). J. Am. Ceram. Soc. 38, 15-17 (1955) Jan.

Practical experience has shown that thermal shock tests do not lead to generally useful test data. This is probably due to the fact that thermal shock failure is a complicated function of the external thermal shock conditions and of the temperature functions of five different material properties. These five material functions appear in a different combination in almost every thermal shock case and cannot be extracted from thermal shock test data. It is recommended that these five properties and their temperature dependence be determined by separate standard tests, not employing thermal shock. If the five property functions are known, thermal shock tests proper can be used to determine the maximum thermal shock stresses in any device. (auth)

1497

THERMAL SHOCK ANALYSIS OF SPHERICAL SHAPES. W. B. Crandall and J. Ging (State Univ. of New York, Alfred). J. Am. Ceram. Soc. 38, 44-54(1955) Jan.

A method is described for studying the thermal shock characteristics of a brittle material. An analysis of the thermal stresses developed in a homogeneous isotropic solid sphere has led to the formulation of an equation relating the physical properties of the body to the temperature difference causing failure and time to maximum stress in a single-cycle unsteady-state test. The thermal shock test consisted of plunging a sphere at one uniform temperature into a medium at another temperature. If fracture occurred, the time to fracture was recorded. A large number of tests were run to determine the temperature difference which caused 50% of the spheres to fracture. The thermal shock relationships were tested using a high-alumina body. The physical properties relating to the thermal shock equations were measured, and calculated temperature differences causing failure and times to maximum stress were compared with measured values. Sufficient agreement was found to lend support to the theory. (auth)

1498

GAS SEAL FOR HIGH-TEMPERATURE EXTENSOMETER TENSILE TESTS IN INERT ATMOSPHERES. A. J. Fenner and G. Willoughby (Culcheth Labs., Warrington, Lancs, England). J. Sci. Instr. 31, 472-3(1954) Dec.

VACUUM SYSTEMS

1499

SIMPLIFIED CONSTRUCTION OF A STRAIGHT-THROUGH, METAL, O-RING-SEALED, VACUUM STOPCOCK. G. W. Green (Atomic Energy Research Establishment, Harwell, Berks, England). J. Sci. Instr. 31, 473(1954) Dec.

WASTE DISPOSAL

1500

CONCENTRATION OF RADIOACTIVE AQUEOUS WASTES. ELECTROMIGRATION THROUGH ION-EXCHANGE MEMBRANES. W. R. Walters, D. W. Weiser, and L. J. Marek (Argonne National Lab., Lemont, Ill.). Ind. Eng. Chem. 47, 61-7(1955) Jan.

Based on experimental data, an electrolytic process incorporating permselective membranes and granular ion exchangers for treatment of radioactive aqueous wastes is proposed. The first step in the process involves partial decontamination in a multicompartment membrane cell of the same general type proposed for producing potable water from saline waters, followed by final decontamination in a multicompartment permselective cell containing a mixed bed granular exchanger in the deionization compartments. For low solids wastes power cost is less than for vapor compression distillation and volume reduction is higher than for chemically regenerated ion exchangers. (auth)

1501

CATION EXCHANGE REMOVAL OF RADIOACTIVITY FROM WASTES. H. Gladys Swope and Elaine Anderson (Argonne National Lab., Lemont, Ill.). Ind. Eng. Chem. 47, 78-83(1955) Jan.

Laboratory studies on the use of a cation exchanger for the removal of mixed fission product activity from tap water are discussed. A sulfonic acid-type cation exchanger can remove 75 to 80% beta-gamma activity over long periods of time. The resin capacity for removing radioactivity to this extent is >260,000 gallons per cubic foot whereas the theoretical capacity is 6000 gallons per cubic foot for tap water containing 300 p.p.m. total solids and 85 p.p.m. of total hardness as calcium carbonate. The 6000 gallons per cubic foot is the point of break-through of total hardness—i.e. leakage of calcium and magnesium ions. This means that low level wastes requiring a removal factor of no more than 80% can be economically processed by a convenience method. The resin can be regenerated or burned. Experiments have been conducted to determine the best operating conditions. A pH of 2.5 provides the best decontamination without filtration. A pH above 8 provides better decontamination but the waste must be filtered to remove precipitated hydroxides or the ion exchange column clogged. A flow rate as high as 10 gallons per cubic foot per minute does not reduce the decontamination obtained. Fission product analysis indicates that ruthenium and cesium are the main radioactive species present in the effluent. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

1502

Institute of Research, Lehigh Univ.
THE INVESTIGATION OF THERMAL AND ELECTRICAL CONDUCTIVITIES OF METALS AT HIGH TEMPERATURE. TECHNICAL REPORT NO. 1. THERMAL AND ELECTRICAL CONDUCTIVITIES OF AISI C-1010 STEEL IN THE RANGE FROM 25° TO 800°C. Spencer D. Raezer. Dec. 31, 1954. 52p. Contract DA-36-034-ORD-1475. (NP-5452)

Values of the thermal and electrical conductivities of AISI C-1010 steel are reported. In earlier work the specimen suffered considerable oxidation during the course of the measurements, and it was thought that perhaps this had caused a larger error than was originally suspected. The measurements were therefore repeated on another specimen of C-1010 steel in a furnace in which the atmosphere could be controlled both as to the nature of the gas and as to its pressure. The Forbes bar method, as developed by Hogan and Sawyer (J. Appl. Phys. 23, 177(1952)), was used, and results are given. (auth)

1503

EFFECT OF SHAPE ON THERMAL FRACTURE. E. M. Baroody, E. M. Simons, and W. H. Duckworth (Battelle Memorial Inst., Columbus, Ohio). J. Am. Ceram. Soc. 38, 38-43(1955) Jan. (cf. NSA 7-1666)

For radial steady-state heat flow through hollow circular cylinders, the usual application of thermoelastic theory indicates that the heat flow per unit length to cause fracture (W_{max}) is simply the product of two factors: M, characterizing the material, and S, the shape. Attention is given to its validity for cylinders with both circular and noncircular cross sections and to measuring the effect of dimensions on S for circular cylinders. Thermal fracture experiments on circular cylinders of two ceramics indicated the manner in which S varies with the ratios of dimensions which define the shape. Changing all dimensions by factors up to 1.6, with these ratios constant, had no noticeable effect on S. Using theorems derived by Biot, it is shown that the product relationship is expected to hold for a considerably wider variety of shapes than the simple circular tube. Experimental results from tubes having cross sections with a circular inner boundary and a circular or square outer boundary support the product relation. Information was obtained on the shape factor for these cross sections and for similar tubes with a triangular outer boundary. (auth)

CERAMICS AND REFRACTORIES

1504

Naval Research Lab.
THERMAL AND RELATED PHYSICAL PROPERTIES OF MOLTEN MATERIALS. PART 1. THERMAL CONDUCTIVITY AND HEAT CAPACITY OF MOLYBDENUM DISILICIDE. C[urtis] T. Ewing and B. E. Baker. July 1954. 33p. (WADC-TR-54-185(pt. 1))

Thermal conductivity and heat capacity figures for hot-pressed molybdenum disilicide are reported to 840°C. The apparatus and method employed for each property study are described in detail. The conductivity coefficients were measured in a longitudinal type system with guard-ring compensation; the heat capacity results were derived from enthalpy measurements made by a drop-method with a copper block calorimeter. A detailed analytical description for each molybdenum disilicide test sample is included, and the change in property value from ideal due to the impurity content or physical form of the test sample is predicted, where possible. (auth)

1505

FACTORS AFFECTING THERMAL STRESS RESISTANCE OF CERAMIC MATERIALS. W. D. Kingery (Massachusetts Inst. of Tech., Cambridge). J. Am. Ceram. Soc. 38, 3-15 (1955) Jan.

The sources and calculation of thermal stresses are considered, together with the factors involved in thermal stress resistance factors. Properties affecting thermal stress resistance of ceramics are reviewed, and testing methods are considered. (auth)

1506

THERMAL FRACTURE OF CERAMIC MATERIALS UNDER QUASI-STATIC THERMAL STRESSES (RING TEST). W. R. Buessem and E. A. Bush (Pennsylvania State Univ., State College). J. Am. Ceram. Soc. 38, 27-32(1955) Jan.

The ring test consists in heating a pile of ceramic rings, each 2 in. outside diameter, 1 in. inside diameter, and ½ in. long, from the inside by a heating element and cooling it from the outside by a calorimetric chamber. The center rings of the pile have radial heat flow. The radial temperature gradient in these center rings can be measured and also the number of calories flowing through their unit surface area. Under equilibrium conditions these measurements yield the thermal conductivity of the ring material. The radial temperature gradient produces thermal stresses in the rings. If the gradient is increased slowly so as to maintain always approximate equilibrium conditions, there will be a maximum gradient which causes failure. The maximum gradient determined by thermal fracture and the thermal conductivity can be used to compute the two thermal stress resistivity constants, R and R′, of the material. R and R′ have been determined for five ceramic materials: porous TiO_2, dense TiO_2, steatite, cordierite, and spodumene. (auth)

1507

EFFECT OF POROSITY ON THERMAL STRESS FRACTURE. R. L. Coble and W. D. Kingery (Massachusetts Inst. of Tech., Cambridge). J. Am. Ceram. Soc. 38, 33-7(1955) Jan.

Sintered alumina with from 4 to 50% porosity was prepared by incorporating crushed naphthalene in a casting slip. Thermal stress resistance was determined from the radial temperature difference required to fracture hollow cylinders under steady-state conditions. Thermal stress resistance decreases with increasing porosity; resistance to thermal stresses at 50% porosity is about one-third of that estimated for zero porosity. (auth)

CORROSION

1508

Battelle Memorial Inst.
SCREENING TESTS ON METALS AND ALLOYS IN CONTACT WITH SODIUM HYDROXIDE AT 1000 AND 1500 F. C. M. Craighead, L. A. Smith, and R. I. Jaffee. Nov. 6, 1951. Decl. June 8, 1953. 36p. Contract W-7405-eng-92. (BMI-706)

Screening corrosion tests were conducted on thirty elemental metals and sixty-two alloys in sodium hydroxide held in nickel containers under a reducing atmosphere at 1000°F. Twenty-three of these materials showed fairly good corrosion resistance at 1000°F, but when tested at 1500°F only four or five of them showed any promise. These were silver, nickel, zirconium, copper, and possibly Monel. Some follow-up tests showed that zirconium, tested in a zirconium container, was severely attacked. The limitations with the others at 1500°F are that at least nickel and silver show thermal-deposition effects, and all are attacked intergranularly. None of these container materials for NaOH look to be really satisfactory for service at 1500°F. (auth)

1509

EFFECT OF MINOR CONSTITUENTS ON THE INTERGRANULAR CORROSION OF AUSTENITIC STAINLESS STEELS. J. J. Heger and J. L. Hamilton (United States Steel Corp., Pittsburgh, Penna.). Corrosion 11, 22-6(1955) Jan.

Results of standard laboratory tests of the corrosion resistance of 18-8 stainless steel indicate the precipitation of minor constituents other than chromium carbide may be significant. Results achieved appear to disagree with those of Bain, Rutherford and Aborn and indicate freedom from intergranular corrosion may be expected only if carbon content is below 0.009 percent, instead of the 0.02 percent they predicted. Tests showed sensitized 18-8 Mo steel containing 0.03 percent maximum carbon content to be corroded in nitric acid at about the same rates as higher carbon 18-8 Mo steels. Metallographic studies using the corroding solution as an etchant indicated that the delta ferrite-austenite grain boundaries were severely attacked with complete loss of some delta ferrite grains. It is postulated that during sensitization some minor constituent forms at grain boundaries of low carbon 18-8 Mo steels and apparently greater at the boundaries separating the delta ferrite from the austenite. The need for an instrument capable of making microchemical analyses is mentioned. (auth)

1510

NOTES ON A SYSTEM FOR RATING PITTING CORROSION. Russell W. Henke (Badger Meter Manufacturing Co., Milwaukee, Wis.). Corrosion 11, 50-2(1955) Jan.

A system is proposed for describing corrosion pits in a metal surface by a combination of agglutinated numbers and letters coded to a schedule rating the five principal characteristics of pitting corrosion. The system would facilitate transmission of pitting data by providing a 10-digit number covering their depth, equivalent diameter (including those of irregular shape), area (expressed as a percentage of total surface), nature of pit walls and time (reduced to a standard interval). Pit depth is expressed as a percentage of material thickness rather than a finite dimension, walls would be rated vertical or gradual in comparison with a 45 degree angle and time would be in penetration per year. Area of pits as percentage of total area would be determined by placing over the pitted surface a transparent grid and comparing the area visually with a conventional standard delineating 10 stages of severity. (auth)

GEOLOGY AND MINERALOGY

1511

Pennsylvania State Univ. Coll. of Mineral Industires
AN INVESTIGATION OF THE MINERALOGY, PETROGRAPHY AND PALEOBOTANY OF URANIUM-BEARING SHALES AND LIGNITES. (SCOPE B—LIGNITES). QUARTERLY PROGRESS REPORT [FOR] PERIOD OF OCTOBER 1, 1953 TO DECEMBER 31, 1953. E. F. Koppe, E. S. Erickson, Jr., C. L. Trotter, R. S. Good, W. Spackman, and T[homas] F. Bates. Jan. 15, 1954. 24p. Contract AT(30-1)-1202. (NYO-6059)

Analyses and sulfur determinations were made upon unweathered, partially weathered, and weathered lignite obtained at site "S.D.-1" in the Slim Buttes area of S. Dak. Changes were noted which can be ascribed to the weathering process. Increased percentages of moisture and volatile matter are recorded upon weathering. Ash content is lower in weathered lignite than it is in unweathered material. The decrease of ash is related to the loss of pyritic sulfur. The first lignite seam at site "S.D.—1" is extremely pyritic in the unweathered portions of the seam. Upon weathering, this form of sulfur is lost. No correlation can be effected between the weathering process and the amount of sulfate sulfur present in the coal. Beta-gamma data demonstrate that the radioactivity is increased twofold in the weathered lignite. This increase is partially attributed to the degree of compaction of the seam upon weathering. An excess of radioactivity is detected which may indicate possible enrichment of the weathered lignite by radioactive substances. Study of clay seam material from the Mendenhall stripping site, site "S.D.-1" and site "B.M.-1", has revealed that the mineral suites found at the three locations were similar in composition but that relative proportions of the component minerals varied. The minerals identified were kaolinite, illite and/or mica, montmorillonite, and quartz. Although the presence of broad groups of clay minerals has been established, the exact nature of the individual minerals present has yet to be established. X-ray data are presented for the mineral identified as kaolinite. Further mineralogical studies on the illite and/or mica material and the montmorillonite are discussed. Electron micrographs disclose very small, relatively dense, discrete particles which are found in seams containing major amounts of kaolinite. The relationship between these particles and the kaolinite is being studied. (For preceding period see NYO-6057.) (auth)

1512

Grand Junction Operations Office, AEC
DRILLING IN THE NORTH POINT NO. 6 AND HORN CHANNELS, WHITE CANYON, SAN JUAN COUNTY, UTAH. Dana R. Kelley. June 1954. June 1954. 33p. (RME-63)

Investigational drilling in the North Point No. 6 and Horn channels was completed. A total of 6,101 ft was penetrated in 52 diamond drill holes. One-foot vertical strip samples were taken at or near the base of the Shinarump sandstone from the cores of 52 holes. Assays of these samples identified two ore holes containing 0.11 % U_3O_8, and seven mineralized holes containing 0.02 % U_3O_8 or better. Gamma-ray logging of one hole in which mineralized core was lost indicated approximately one ft of 0.11 % U_3O_8. The North Point No. 6 channel was traced 5,735 ft by 40 holes, and the Horn channel was traced 1,465 ft by 12 holes. The two channels were traced through 10,100 ft by drilling and by a survey of the rim. Due to the small quantity and low grade of discovered ore, together with weak and non-correlative mineralization, it is believed that the area does not warrant further drilling at this time. (auth)

1513

Grand Junction Operations Office, AEC
RECONNAISSANCE OF URANIUM OCCURRENCES AT WRAY MESA, SAN JUAN COUNTY, UTAH AND MONTROSE COUNTY, COLORADO. Gordon K. Zareski. Oct. 5, 1954. 15p. (RME-69(pt. 1))

Uranium deposits are found in sandstone in the Brushy Basin and Salt Wash members of the Morrison formation on Wray Mesa. In all but two deposits, ore minerals are carnotite and black vanadium minerals. In one deposit in the Brushy Basin member, uranium is contained in an unidentified black mineral; in another deposit, the ore minerals are tyuyamunite and beta-uranotil. The ore bodies are small in size. (auth)

1514

Minnesota Univ.
NINTH PROGRESS REPORT FOR PERIOD APRIL 1 TO OCTOBER 1, 1954. John W. Gruner and Deane K. Smith, Jr. Oct. 1, 1954. 10p. Contract AT(30-1)-610. (RME-3103)

Two months of field work extended geographically from the deposits of South Dakota and Wyoming to those of Northern New Mexico and Arizona. Unoxidized black ores were studied in particular. While the Black Hills deposits in many respects are very similar to those of the Colorado Plateau, the Powder River and Wind River Basin ones have a different setting and mineralogy. There are exceptions, however, and the statements regarding them are entirely tentative, as there has not been sufficient time to study details. (For preceding period see RME-3099.) (auth)

1515

Geological Survey
RECONNAISSANCE FOR URANIUM IN THE INDIANA COAL FIELD. John L. Snider. Aug. 1954. 28p. (TEM-784)

A radioactivity of 0.001 or more percent equivalent uranium was found in five Indiana coal beds: the Upper Block, Minshall, Gentryville, Coal V, and Coal VII. The radioactive coal is local and the reserves are small. The radioactivity is in the top part of the bed in the thick coals. Most of the radioactive coal has a high percentage of ash. The black carbonaceous shale above Coal V and the Minshall coals contains about 0.006 and 0.003% equivalent uranium, respectively, and the radioactivity appears to increase as the amount of organic matter increases in the shale. The black shale above Coal V is widespread in Indiana and adjacent states and the reserves of shale are large. (auth)

1516

URANIUM IN THE EAST WALKER RIVER AREA, LYON COUNTY, NEVADA. M. H. Staatz and H. L. Bauer, Jr. U. S. Geol. Survey Bull. 988-C, 1953. 15p. $0.35 (GPO).

Uraniferous quartz veins and uraniferous deposits of other types occur in an area at least 6 miles long and 3 miles wide, along the East Walker River in Lyon County, Nev. Most of the deposits are on the west side of the river. Six properties or areas were mapped, sampled, and tested radiometrically. These properties are: the Far West Willys group, Northwest Willys group, West Willys group, Silver Pick property, Grant View hot spring, and the Boerlin ranch radioactive area. The East Walker River area is underlain by coarse-grained porphyritic granite. Cutting the granite are numerous aplite dikes and a few perthite-quartz pegmatites. Faults were seen in a few places. Radioactive material was found in the East Walker River area in deposits of four types: (1) quartz veins carrying small amounts of copper, lead, and silver minerals; (2) partly altered granite adjacent to quartz veins; (3) gouge zones; and (4) hot springs. The quartz vein deposits are the most abundant. The uranium minerals pitchblende and kasolite occur in the quartz veins, in aggregates and streaks associated with copper and silver minerals, galena, and barite. In many quartz veins abnormal radioactivity is absent or only locally present. Samples collected from quartz veins contain from 0.001 to 0.14% uranium; only 5 of 46 samples contain more than 0.025% uranium. Partly altered granite adjacent to the quartz veins in the West Willys No. 7 property contains scattered torbernite, but the highest uranium content in deposits of this type is 0.006%. The third type of deposit is represented on the Silver Pick property, where a gouge zone of differing thickness contains scattered flakes of torbernite. Five samples from this deposit contain from 0.005 to 0.013% uranium. The Grant View hot spring is moderately radioactive near the point where it issues from the hillside. Laboratory analysis of both water and sand from this deposit shows little uranium content (0.02 ppm) and little radioactivity, which indicates that the radioactivity is due to some short-lived daughter product, probably radon. The uraniferous material found to date in the area is of too low grade and small size to be of value at present. (auth)

1517

RADIOACTIVITY IN SOME OIL FIELDS OF SOUTHEASTERN KANSAS. Garland B. Gott and James W. Hill. U. S. Geol. Survey Bull. 988-E, 1953. 54p. $1.00 (GPO).

Radium-bearing precipitates derived from oil-well fluids have been found in more than 60 oil and gas fields in Cowley, Butler, Marion, Sedgwick, and Greenwood Counties of southeastern Kansas. The abnormal radioactivity of these precipitates has been studied by means of gamma-ray and sample logs; by radiometric, chemical, petrographic, and spectrographic analyses of the precipitates and drill samples; and by chemical analyses of brines collected from oil wells in the areas of high radioactivity. The most radioactive precipitates were collected from a narrow belt, roughly marginal to the Nemaha anticline, that extends from the southern part of Marion County southward to near the Kansas-Oklahoma boundary. The conclusion that significant quantities of uranium may be present in the subsurface rocks is based largely on the following evidence: 1. Vuggy limestones and dolomites that contain as much radium as would be present with 0.5 percent uranium strongly suggest that uranium has only recently been leached, perhaps by the drilling fluids at the time the well was drilled. The radium now present in the precipitates was probably derived from these rocks. 2. Contact-metamorphic or hydrothermal-type minerals in altered limestones indicate that hydrothermal solutions have penetrated the limestones and suggest that uranium may have been deposited from those solutions. 3. The large amount of radium in some of the precipitates suggests that it was derived from rocks that contain an abnormal concentration of uranium. 4. The association of helium with other uranium-decay products suggests that the helium is radiogenic. So much radiogenic helium would require a large body either of uranium or thorium, and the presence of radium indicates that uranium rather than thorium is present. (auth)

1518

URANIUM-BEARING DEPOSITS WEST OF CLANCEY, JEFFERSON COUNTY, MONTANA. Wayne A. Roberts and Arthur J. Gude, III. U. S. Geol. Survey Bull. 988-F, 1953. 19p.

Nine uranium deposits occur in a small area west of Clancey, Jefferson County, Mont. These deposits are all in or near silicified fracture zones in quartz monzonite and related rocks of the Boulder batholith. The deposits contain pockets of uranium minerals in cavities in brecciated silicified rock. The primary uranium mineral pitchblende has been found in one pod. Secondary uranium minerals occur as fracture linings and in pore spaces in and adjacent to the silicified zones. Uranium in the Clancey district was deposited probably during one of the later of at least four periods of silicification. The quartz monzonite, rather than the younger alaskitic dike rocks, is the host rock of the deposits. (auth)

1519

GEOLOGY OF THE AREA ADJACENT TO THE FREE ENTERPRISE MINE, JEFFERSON COUNTY, MONTANA. W. A. Roberts and A. J. Gude, III. U. S. Geol. Survey Bull. 988-G, 1953. 13p.

Uranium minerals occur in a silver-bearing, cryptocrystalline silica vein deposit that cuts quartz monzonite and alaskite at the Free Enterprise mine, 2 miles west of Boulder, Mont. The Free Enterprise vein is one of many silicified reeflike structures in this area, most of which trend about N. 60° E. The cryptocrystalline silica veins commonly occur in groups having a lenticular pattern. Where quartz monzonite is the wall rock, they are bordered by an altered zone, but no alteration was noticed where alaskite is adjacent to the silica veins. These groups of silica veins and the enclosing altered country rock are called silicified zones in this report. No uranium minerals were observed at the surface, but radioactivity anomalies were noted at 57 outcrops. Leaching by downward percolating waters has removed most of the uranium from the near-surface part of the Free Enterprise vein and probably has slightly enriched parts of it and the adjacent wall rock from the bottom of the leached zone to the groundwater level. The quartz monzonite appears to be a more favorable host rock for this cryptocrystalline silica veins and associated uranium minerals than the alaskite.

Alaskite occurs as vertical dikes and plug-like masses and as irregularly shaped, gently dipping masses. The smaller bodies probably were introduced into open fractures formed during the cooling of the quartz monzonite. The nature of the Free Enterprise deposit, the abundance of silicified veins, and the weak to moderate surficial radioactivity of some of these veins suggest that many small deposits of uranium and silver minerals may occur in this area in significant concentrations at relatively shallow depth. (auth)

1520

URANIUM AND THORIUM DEPOSITS IN EAST-CENTRAL IDAHO AND SOUTHWESTERN MONTANA. Albert F. Trites, Jr., and Edwin W. Tooker. U. S. Geol. Survey Bull. 988-H, 1953. 53p $0.35 (GPO).

In 1950, 39 mines and prospects in east-central Idaho and southwestern Montana were examined radiometrically to determine the grade, reserves, and mode of occurrence of uranium and thorium. Uranium occurs principally in gold, lead, copper, and quartz-hematite veins that cut pre-Cambrian quartzite and phyllite of the Belt series and Paleozoic limestone and shale. The uranium minerals that have been identified, torbernite and autunite, are associated with pyrite, galena, malachite, and hydrous iron oxides. These deposits are estimated to contain 0.02 to 0.1% uranium. Known reserves are small. Thorium occurs in significant amounts in three copper-bearing veins and in at least nine quartz-hematite veins. One copper-bearing vein is in pre-Cambrian hornblende gneiss; the other veins cut argillite, sandstone, quartzite, and schist of the Belt series. The thorium occurs principally as thorite and as hydrothorite (?). The thorite is in very small, altered, red-brown prismatic crystals associated with hematite, hydrous iron oxides, and barite. The hydrothorite (?) is believed to occur in the mixture of hydrous iron oxides. Minor quantities of monazite and allanite are found in some of the deposits, but they are not considered significant sources of thorium. These deposits are believed to contain 0.1 to 1.2% thoria (ThO_2). (auth)

1521

PROSPECTING FOR URANIUM WITH CAR-MOUNTED EQUIPMENT. John M. Nelson. U. S. Geol. Survey Bull. 988-I, 1953. 11p. $0.15 (GPO).

The U. S. Geological Survey has prospected for uranium with a car-mounted Geiger-Mueller counter since 1945. The basic principles of the car-traverse technique are simple. Rocks and soils of abnormally high uranium or thorium content are surrounded by an equivalently high gamma radiation field. An abnormal gamma-radiation field that extends across a road or highway can be detected at relatively high speeds by a car or truck equipped with a suitable Geiger-Mueller counter. Once detected by car-traversing, the deposit can be examined with light portable instruments, and the better portions sampled. The prime advantage of the car-traverse technique is the rapidity of the scanning process, 100 to 200 miles per day, which permits exploration of large areas in a short time. (auth)

1522

HAFNIUM CONTENT AND HAFNIUM-ZIRCONIUM RATIO IN MINERALS AND ROCKS. Michael Fleischer. U. S. Geol. Survey Bull. 1021-A, 1955. 13p. $0.15 (GPO).

All published data on the hafnium content and hafnium/zirconium ratio in minerals and rocks have been compiled. The Hf/Zr ratio is probably about 0.02 in the earth's crust. Minerals from alkalic rocks such as nepheline syenites have lower Hf/Zr ratios than does zircon from granitic rocks. Minerals from granitic pegmatites have the highest Hf/Zr ratios, especially some peculiar varieties of zircon such as alvite, cyrtolite, and naegite, and the rare scandium silicate, thortveitite, which is the only mineral that is reported to contain more hafnium than zirconium. (auth)

1523

PRELIMINARY SUMMARY REVIEW OF THORIUM-BEARING MINERAL OCCURRENCES IN ALASKA. Robert G. Bates and Helmuth Wedow, Jr. U. S. Geol. Survey Circ. 202, 1953.

Thorium-bearing minerals are known at 47 localities in Alaska. At these localities the thorium occurs as a major constituent or in minor amounts as an impurity in one or more of the following 12 minerals: allanite, columbite, ellsworthite, eschynite, gummite, monazite, orangite, parisite, thorianite, thorite, xenotime, and zircon. In addition other minerals, such as biotite and sphene, are radioactive and may contain thorium. Several unidentified niobate minerals with uranium or uranium and thorium as major constituents have been recognized at some localities. The distribution, by type of deposit, of the 47 thorium occurrences is as follows: lode, 3; lode and placer, 1; granitic rock, 3; granitic rock and related placer, 14; and placer, 26. Of the four lode occurrences only the radioactive veins at Salmon Bay in southeastern Alaska and the contact metamorphic deposit in the Nixon Fork area of central Alaska warrant further consideration as possible commercial sources, although insufficient data are available to determine whether these two deposits have such possibilities. The remaining occurrences of thorium-bearing minerals in Alaska are limited to placer deposits and disseminations of accessory minerals in granitic rocks. In most of these occurrences the thorium-bearing minerals occur in only trace amounts and consequently warrant little further consideration. More data are needed to determine the possibilities of byproduct recovery of thorium-bearing minerals from several of the gold and tin placers. (auth)

1524

A URANIUM-BEARING RHYOLITIC TUFF DEPOSIT NEAR COALDALE, ESMERALDA COUNTY, NEVADA. D. C. Duncan. U. S. Geol. Survey Circ. 291, 1953. 7p.

A small deposit of uranium-bearing rhyolitic tuff is exposed at the northern end of the Silver-Peak Mountains about 4 miles south of Coaldale in Esmeralda County, Nev. The deposit consists of weakly mineralized welded tuff containing veinlets and small irregular pods of higher grade uranium-bearing rock. The conspicuous ore minerals are autunite and phosphuranylite, which coat some fractures and partly fill some feldspar crystal cavities in the tuff. Uranium is also present in small amounts in siliceous material that occurs as scattered veinlets and as matrix of a breccia pipe. Numerous limonite-stained joint surfaces on the welded tuff also contain small amounts of uranium. No identifiable uranium minerals were found in the siliceous vein material or in the limonite-stained fracture coatings. Several samples collected from weathered outcrops contained from 0.002 to 1.86% uranium. (auth)

1525

PRELIMINARY GEOLOGIC MAP OF THE ATKINSON CREEK QUADRANGLE, COLORADO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 18. E. J. McKay. Washington, U. S. Geol. Survey, 1954. $0.25.

1526

AIRBORNE RADIOACTIVITY SURVEY OF THE FORT MYERS AREA, CHARLOTTE AND LEE COUNTIES, FLORIDA. GEOPHYSICAL INVESTIGATIONS MAP GP 121. J. L. Meuschke. Washington, U. S. Geol. Survey, 1955. $0.50.

METALS AND METALLURGY

1527

Massachusetts Inst. of Tech.
RESEARCHES ON MOLYBDENUM WELDING. FINAL REPORT. PART 1. THE INFLUENCE OF OXYGEN ON THE MECHANICAL PROPERTIES OF HEAT-TREATED MOLYBDENUM RELATED TO JOINING. Timothy Perry, H. S. Spacil, and John Wulff. PART 2. JOINING OF MOLYBDENUM. James H. Johnston, Harry Udin, and John Wulff. PART 3. MOLYBDENUM CYLINDERS. Richard B. Palme, James Wong, and John Wulff. Dec. 31, 1953. 67p. Contract AF 33(616) 361. (AD-28462)

The properties of Mo sheet produced by the powder metallurgy, arc-casting, and halogen reduction processes including grain growth, recrystallization temperatures, room-temperature ultimate tensile strengths, percentage elongation, annealing effects, transition temperatures, and bend-test results on the specimens are compared. An investigation of the action of O_2 on the properties of Mo was made and results are given. The formation, some properties, and the effect of inclusions of MoO_2 and MoO_3 in Mo metal are discussed. A review of the literature and a discussion of experimental results on the joining of Mo by fusion, spot, and butt welding, brazing, and riveting including the mechanical properties of each are presented. The fabrication of long, thin-walled Mo tubes by H_2 reduction of $MoCl_5$ is discussed. (J.A.G.)

1528

Battelle Memorial Inst.
THE TITANIUM—MANGANESE, TITANIUM—TUNGSTEN, AND TITANIUM—TANTALUM PHASE DIAGRAMS. D. J. Maykuth, H. R. Ogden, R. I. Jaffee, J. W. Holladay, and J. G. Kura. July 1954. 94p. Contract AF33-(038)-8544. (AF-TR-6516(pt. 2))

Phase diagrams for the binary systems Ti—Mn, Ti—W, and Ti—Ta were determined using both high-purity and commercial titanium. Manganese shows appreciable solubility in beta titanium, and the beta phase field terminates in a very sluggish eutectoid reaction. Two compounds were found over the alloy range of the Ti—Mn system investigated. The Ti—W system is characterized, at high temperatures, by a broad beta-plus-tungsten field which originates from a peritectic reaction. At lower temperatures, an alpha-plus-tungsten phase field extends across the diagram as a result of eutectoidal decomposition of the beta phase. Beta titanium and tantalum are completely isomorphous. Tantalum shows appreciable solubility in alpha titanium. An extensive alpha-plus-beta field exists at low temperatures. Investigation disclosed that additions at the contaminant level of oxygen or nitrogen to high-purity Ti—Mn alloys have a profound effect on alloy structure. Data were also obtained on the density, hardness, hot-air oxidation resistance, and mechanical properties of binary titanium-rich manganese, tungsten, and tantalum alloys prepared using iodide titanium. (auth)

1529

Smith, A. O., Corp.
TITANIUM. SUMMARY REPORT. H. E. Bernhardt. Jan. 31, 1952. 19p. Contract AF33(038)-20582. (ATI-161851; AD-167)

Flash welds in $^5/_8$ in. diam. Ti of commercially pure and alloy material can be successfully made. Attempts to join Ti to other metals have been successful. Joint tensile strengths up to 192,000 psi have been obtained with a specific alloy welded to similar stock. Forging experiments have been limited to a simple hot flattening test. Because only a single test was made at each temperature, the scatter of data makes precise evaluation difficult. (auth)

1530

Armour Research Foundation
A STUDY OF THE MECHANISMS OF HEAT TREATMENT OF ZIRCONIUM-BASE ALLOYS. STATUS REPORT NO. 1, JULY 1, 1954—DECEMBER 31, 1954. Jan. 3, 1955. 14p. Contract AT(11-1)-315. (COO-206)

Alloys containing 1, 3, and 5% molybdenum; 4, 7.5, and 11% tin; and 5, 15, and 35% titanium were double arc melted and forged to stock material. Resistivity bars were prepared, and a study of transformation kinetics is currently in progress. A cursory study of the Zr—Nb and Zr—Ta systems has shown them to be eutectoid in type with the β solid solution decomposing into $\alpha + X$. Solubilities of both niobium and tantalum were found to be quite high in β zirconium. (auth)

1531

Rensselaer Polytechnic Inst.
DETERMINATION OF THE NOTCH SENSITIVITY OF WELD HEAT AFFECTED ZONES IN VARIOUS ALLOYS. INTERIM REPORT NO. 2. NOTCH SENSITIVITY OF THE WELD HEAT-AFFECTED ZONES IN A 5%Cr—3%Al TITANIUM ALLOY. Ernest F. Nippes and John M. Gerken. Nov. 1954. 27p. Contract DA-30-115-ORD-490. (NP-5454)

A 5%Cr—3%Al titanium alloy was studied to determine the effects of the various weld thermal cycles on the notch toughness of the heat-affected zone in this material. The individual thermal cycles for an energy input of 50,000 j/in. using 0.5-in. Ti alloy plate with no preheat were reproduced in Charpy V-notch impact specimens using a time-temperature controller. In addition, a study of the continuous cooling transformation of this alloy was made over a large range of cooling rates. (auth)

1532

Battelle Memorial Inst.
LITERATURE SURVEY ON WELD-METAL CRACKING. (The First of a series of reports on WELD-METAL CRACKING). A. J. Williams, P. J. Rieppel, and C. B. Voldrich. Aug. 1952. 111p. Contract AF33(038)-12619. (WADC-TR-52-143)

As the initial part of an investigation on the causes of cracking in high-strength weld metal, a literature survey was made. Work on wrought and cast steel was included in this survey, since it is the most prolific source of information on this subject. Of the various phenomena which might be pertinent, hot tearing, hot shortness, blue brittleness, and hydrogen embrittlement appeared to be closely related to the causes of weld-metal cracking. Investigators agree that most weld-metal cracking initiates at high temperatures in the boundaries between grains or dendrites. This type of cracking is generally attributed to the presence on these boundaries of low-melting-point or "brittle" compounds — complex sulfides, for example. Most types of low-temperature cracks in weld metal appeared to be associated with rapid cooling rates and hydrogen. As a result of this survey, the experimental program on this investigation will involve weld-metal cracking tests, studies of grain-boundary constituents which might cause cracking, preparation of special weld-metal compositions, and tests to determine the temperature at which cracking occurs. (844 references.) (auth)

1533

Carnegie Inst. of Tech.
[RESEARCH AND DEVELOPMENT ON THE FATIGUE PROPERTIES OF TITANIUM AND ITS ALLOYS]. EFFECT OF SPEED OF TESTING AND INTERNAL HEATING ON THE FATIGUE BEHAVIOR OF NOTCHED SPECIMENS OF TITANIUM AND ITS ALLOYS. FINAL REPORT. J. G. Kaufman, R. G. Crum, and E. D'Appolonia. Nov. 1954. 32p. Contract DA-36-061-ORD-362. (WAL-401/68-47)

The notch effect on the fatigue behavior of five Ti alloys was studied. Unnotched specimens of each alloy were tested at 10,000 and 1,800 rpm with and without a water coolant. Notched specimens were tested with coolant at 10,000 rpm. Data obtained from previous tests were correlated with results of this study. To evaluate properly the fatigue strength-reduction factor of the Ti alloys, the thermal conditions of testing for notched and unnotched specimens must be the same. A water coolant sprayed on notched and unnotched specimens was used to maintain isothermal conditions. The internal heat generated during cyclic loading is transferred to the water. Consequently, the harmful effects of thermal softening on the fatigue behavior of Ti specimens are practically eliminated. A notch localizes the region of high stress. Thereby the volume which undergoes plastic distortion is reduced. Nearly all the heat generated by notched specimens is dissipated to the surrounding air as rapidly as it is generated. Significant thermal softening is not observed with notched Ti specimens. (auth)

1534

Armour Research Foundation
DEVELOPMENT OF TITANIUM-BASE ALLOYS OF HIGH STRENGTH AND TOUGHNESS. INTERIM TECHNICAL REPORT NO. 2 [FOR] JANUARY 1, 1954—APRIL 30, 1954. C. R[obert] Lillie and D. J. McPherson. Sept. 22, 1954. 25p. Contract DA-11-022-ORD-1428. (WAL-401/203-3)

The $\beta/\alpha + \beta$ transformation temperatures of six Al—Mn—Ti alloys and nine Al—Si—Ti alloys were determined, and tensile and hardness tests in the as-forged condition, after two aging treatments are reported. The results of subcritical aging treatments of the Al—Si—Ti alloys are also reported. Processing data and mechanical properties of a 0.5-in. plate of Al—Ti—V alloy are given. The effects of section size on the properties of a heat-treated Al—Cr—Ti alloy are reported. (J.A.G.)

1535

Watertown Arsenal Lab.
SURVEY AND BIBLIOGRAPHY ON THE DETERMINATION OF THERMAL CONDUCTIVITY OF METALS AT ELEVATED TEMPERATURES. Richard D. Seibel. Aug. 15, 1954. 66p. (WAL-821/9)

Several methods of measuring the thermal conductivity of metals are available. Many of these methods measure the temperature drop when heat flows in one dimension in a solid body. Various techniques which yield absolute or comparative values are described. The Forbes bar and the dynamic methods yield the conductivity by giving a value for the thermal diffusivity. The thermal conductivity can also be estimated from the electrical conductivity in some materials. Thermal conductivity varies with the temperature for any particular material and is related to the specific heat, density and the chemical composition. Information from the literature is consolidated in graphical form to illustrate the effect of temperature and composition on the thermal conductivity. Many heat resistant materials are included. An extensive bibliography and subject index on thermal conductivity has also been compiled covering the literature through July, 1954. 300 references. (auth)

1536

THE EXTENDED RULE OF MATTHIESSEN. W. Geiss and J. A. M. v[an] Liempt. Translated by R. S. Forsyth from Z. Physik 41, 867-7(1927). 4p. (AERE-Lib/Trans-471)

Matthiessen's Rule, the product of the specific resistance and the temperature coefficient of resistance of a metal is a constant, has been extended to cold-worked metals. The rule has been proved to be correct for cold-worked W, Mo, Ni, and Pt. (M.P.G.)

1537

RELAXATION EFFECTS IN SOLID SOLUTIONS ARISING FROM CHANGES IN LOCAL ORDER. II. THEORY OF THE RELAXATION STRENGTH. A. D. LeClaire and W. M. Lomer (Atomic Energy Research Establishment, Harwell, Berks, England). Acta Met. 2, 731-42(1954) Nov.

The lattice dimensions of an alloy depend upon the degree of short-range order σ. Thus the equilibrium value of σ in a strained crystal will in general differ from that in the unstrained crystal, and in addition to the elastic strain following an applied stress, there will be an anelastic strain arising from the change to the new stress induced equilibrium value of σ. An interal friction peak frequently found in substitutional solid solutions is attributed to this type of anelastic effect and on the basis of the regular solution model a calculation is made of the associated relaxation strength ö. Very satisfactory agreement is found between the theoretical values of o and the measured values for α-CuZn, α-AgZn, and CuAl alloys. The theory is critically compared with an earlier interpretation of the experimentally observed effect by Zener, who employed a concept of stress induced reorientation of solute atom pairs. (auth)

1538

THE RESISTIVITY-TEMPERATURE-CONCENTRATION RELATIONSHIPS IN THE SYSTEM NIOBIUM-TITANIUM. S. L. Ames and D. A. McQuillan (Univ. of Birmingham, England). Acta Met. 2, 831-6(1954) Nov.

The resistivity of a series of β-phase niobium-titanium alloys has been measured over the temperature range 88°K to 1173°K. The form of the resistivity-temperature-concentration relationships is abnormal, particularly at low temperatures. Additions of titanium to niobium cause a progressive increase in resistivity and a decrease in the temperature coefficient of resistance until, in β-phase alloys containing less than 25 at. % niobium, the temperature coefficient of resistivity becomes negative. Although the β phase in alloys containing less than 20 at.% niobium cannot be retained at low temperatures, extrapolation of the isothermal resistivity-concentration curves for the β solid-solution to zero niobium content seems to indicate that pure β-titanium would show a semi-conducting type of behavior at temperatures approaching the absolute zero. The validity of the extrapolation is discussed. (auth)

1539

THE INFLUENCE OF ALUMINUM ON THE OCCUPATION OF LATTICE SITES IN THE TiAl PHASE. R. P. Elliott and W. Rostoker (Armour Research Foundation and Illinois Inst. of Tech., Chicago). Acta Met. 2, 884-5(1954) Nov. (In English)

1540

LARGE MAGNETIC KERR ROTATION IN BiMn ALLOY. B. W. Roberts and C. P. Bean (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 96, 1494-6(1954) Dec. 15.

Ferromagnetic domains in BiMn crystallites are found to be easily observed by utilizing plane polarized light in reflection. A crystallite viewed parallel to the c_0 axis shows a characteristic "rick rack" or zigzag pattern of domains as a stable configuration in zero field. Magnetic domain patterns reminiscent of spiral surface growth are observed. The large magneto-optic rotation is thought to be due to the high resistivity of BiMn alloy. (auth)

1541

EFFECT OF DESIGN, FABRICATION AND INSTALLATION ON THE PERFORMANCE OF STAINLESS STEEL EQUIPMENT. James A. Collins. Corrosion 11, 27-34(1955) Jan.

Case histories are presented of failure in austenitic type stainless steel chemical process equipment the recurrence of which have been prevented by improved design, better fabrication or installation. Thermal fatigue, concentration cell corrosion, and stress corrosion cracking failures are considered. (auth)

1542

IMPORTANT ADVANTAGES OF TITANIUM IN THE CHEMICAL INDUSTRY. W. G. Renshaw and Perry R. Bish (Allegheny Ludlum Steel Corp., Brackenridge, Penna.). Corrosion 11, 57-63(1955) Jan.

Valuable properties of titanium are discussed with emphasis on its good resistance to specific types of corrosion, including pitting, stress and intergranular corrosion. Titanium's influence in making design problems simpler is discussed. Passivity of titanium under oxidizing conditions resembles that of certain other metals but is distinctly different under some conditions. Some conditions which promote passivity and a stable passive state are discussed. Inhibitors are unusually effective in certain corrosive media where other passive metals are not benefited. Studies of titanium's passivating characteristics and the presence or absence of certain components in the environment may explain behavior of the metal in dry halogens and certain other media. Moist environments appear to be conducive to passivity while the reverse is often true for other metals in some of these severe applications. (auth)

1543

TITANIUM-URANIUM SYSTEM IN THE REGION 0 TO 30 ATOMIC PERCENT OF TITANIUM. R. W. Buzzard, R. B. Liss, and D. P. Fickle. J. Research Natl. Bur. Standards 50, 209-14(1953) Apr.

The tentative titanium-uranium phase diagram was amplified by thermal, microscopic, and x-ray analyses of alloys in the range 0 to 30 at.% of titanium. The system is characterized by a peritectic reaction which occurs at 1,180°C, and by two solid-solution phases which decompose eutectoidly, one at 718°C and 5 at.% of titanium, the other at 830°C and 18.3 at.% of titanium. The alpha-beta transformation in uranium is increased from 657 to 667°C by titanium, and the beta-gamma transformation is lowered from 768 to 718°C. (auth)

1544

DETERMINATION OF NICKEL, MANGANESE, COBALT, AND IRON IN HIGH-TEMPERATURE ALLOYS, USING ANION-EXCHANGE SEPARATIONS. John L. Hague, Edwin E. Maczkowske, and Harry A. Bright. J. Research Natl. Bur. Standards 53, 353-9(1954) Dec.

A procedure is given for the determination of Ni, Mn, Co, and Fe in a high-temperature alloy. Nb, Ta, W, and Si, are rendered insoluble by HCl dehydration after solution of the alloy in aqua regia. Mo and Cu are precipitated with hydrogen sulfide, and the solution is filtered. The filtrate is evaporated several times with HCl and hydrogen peroxide to obtain a chloride solution of these elements in the proper valence. The resulting solution is transferred to an anion-exchange column containing Dowex-1. The Ni and Mn, with Cr and some other elements, are collected in the first fraction by elution with 9N HCl. Co is collected in a second fraction by elution with 4N HCl and Fe in a third by elution with 1N HCl. The cobalt is determined by electrolysis from a weakly ammoniacal chloride solution containing hydroxylamine hydrochloride, and the other elements are determined by conventional methods. (auth)

1545

EXAGGERATED GRAIN GROWTH IN EXTRUSIONS. D. H. Locke (U. K. Atomic Energy Authority, Springfields, Preston). Metallurgia 50, 268-75(1954) Dec.

The exaggerated grain growth found in extrusions results from a combination of the complex flow conditions which prevail during the extrusion operation and the subsequent heat treatment. Although several practical solutions of the problem have been suggested, they are nearly all open to criticism, and the author concludes that a detailed study of grain growth would provide further useful information on this question. (auth)

1546

EQUILIBRIUM BETWEEN TITANIUM IN LIQUID IRON AND TITANIUM OXIDES. R. L. Hadley (General Electric Co., Louisville, Ky.) and G. Derge (Carnegie Inst. of Tech., Pittsburgh, Penna.). J. Metals 7, 55-60(1955) Jan.

The amounts of oxygen in liquid iron-titanium alloys up to 50% Ti were measured, and the oxide phases in equilibrium with these alloys were determined by using TiO_2 crucibles. A minimum of about 0.003% O occurs at less than 1% Ti. The various liquid and solid oxide phases can be arranged on a ternary isotherm. (auth)

1547

MARTENSITE FORMATION IN POWDERS AND LUMP SPECIMENS OF Ti-Fe ALLOYS. D. H. Polonis and J. Gordon Parr (Univ. of British Columbia, Vancouver, Canada). J. Metals 7, 64(1955) Jan.

1548

PRODUCTION OF LARGE SINGLE CRYSTALS OF ALUMINUM OF GIVEN ORIENTATION. N. S. Andreeva and P. A. Bezirganyan. Zhur. Tekh. Fiz. 24, 1876-8(1954) Oct. (In Russian)

1549

HOW NOTCH SENSITIVE ARE TITANIUM ALLOYS? F. R. Brotzen (Rice Inst., Houston, Tex.) and E. L. Harmon, Jr.

and A. R. Troiano (Case Inst. of Tech., Cleveland, Ohio). Iron Age 174, No. 27, 52-5(1954) Dec. 30.

Titanium alloys containing vanadium show a strong relationship between notch sensitivity and alloy composition. Data on notch behavior were gathered from specimens subjected to various heat treatments. Radial strain gages were used to obtain strain data. Microstructure did not have an important effect on notch sensitivity. Notch strength tended to increase uniformly with greater notch depth. Notch sensitivity of a titanium–vanadium alloy compares favorably with an aluminum alloy of similar strength level. (auth)

PHYSICS

1550

Engineering Research Inst., Univ. of Mich.
UTILIZATION OF THE GROSS FISSION PRODUCTS. PROGRESS REPORT NO. 7. L. E. Brownell, L. C. Anderson, H. J. Gomberg, L. L. Kempe, J. J. Martin, J. V. Nehemias, and R. A. Wolfe. Dec. 1954. 249p. Contract AT(11-1)-162. (AECU-2981)

Data are presented on the effects of β radiation on the spark ignition of a mixture of combustible gases; the polymerization of ethylene under γ radiation; the chlorination of toluene under γ radiation; and design of a chemical plant to chlorinate benzene under γ irradiation for the production of insecticides. Low dosages of γ radiation were found to increase the refrigerator storage life of raw, ground pork and beef and prepackaged coleslaw, as indicated by taste-panel tests. An irradiation sufficient to prevent insect infestation of flour or wheat showed no undesirable effects on the taste and baking qualities of wheat flour. Low γ dosages were found to prevent the sprouting of potatoes and onions during storage, and a potato irradiation facility was designed. A comparison was made of the cost of Cs^{137}, mixed fission products, and cooling reactor fuel elements as radiation sources. No induced activity was observed by means of a scintillation well counter following high-level Co^{60} γ irradiation of 24 elements found in foods. Studies were made of effects of an irradiated diet on growth and reproduction of laboratory animals; the effects of radiation on elastomers; effects of radiation on plants; the effect of radiation treatment on tissue transplants for dogs; and effects of irradiation on green and roasted coffee and the germination or irradiated walnuts. (For preceding period see COO-198.) (C.H.)

1551

Los Alamos Scientific Lab.
ON THE INTERACTION OF A SHOCK WITH A CONSTRICTION. Otto Laporte. Aug. 1954. 30p. Contract W-7405-eng-36. (LA-1740)

A detailed theoretical treatment of the passage of a shockwave along a channel possessing a constriction of area reduction at one point is given. The purpose is to furnish a theory of the diffraction of a shock by a flat plate which has upon it a regular array of perpendicular spikes or wedges. The pressures, densities, and temperatures encountered are calculated assuming a monatomic gas and ideal gas law. Two entirely different treatments have to be employed according as the Mach number at the constriction is less or greater than unity. Numerical results are presented for constriction ratios 2:1, 5:1, and ∞:1. Of interest to experimental investigators are quantitative predictions on the possibility of attaining greater shock strengths in this way and of, therefore, exceeding the inherent limitations of a shock tube. (auth)

1552

Little, Arthur D., Inc.
LOW TEMPERATURE BIBLIOGRAPHY FOR THE FIELD OF CRYOGENICS. SUPPLEMENT NO. 5. Nov. 1954. 11p. (NP-4859(suppl. 5))

An author index of recently published articles in the field of cryogenics has been compiled. (M.P.G.)

1553

Naval Research Lab.
ENGINEERING PHYSICS OF DIELECTRICS. PROGRESS REPORT NO. 1. A. T. McClinton, Herbert Rabin, E. L. Brancato, and R. S. Phillips. Apr. 1, 1953. 43p. (NRL-Memo-146)

Progress is reported on the literature study of the radiation effects on dielectrics, procurement of a 2000-c source of Co^{60} and a 2-Mev Van de Graaff electron accelerator, and research in developing instrumentation to measure the electrical properties of insulators continuously during irradiation. Preliminary tests were performed on number-26-wire-wound coils of Teflon, Formex, and Fiberglas. The results of d-c resistance measurements with Teflon test coils are shown graphically. The effects of humidity and cycling on the thermal aging of Formex and Teflon insulation and the aging of fractional horsepower and model motors are discussed. The nondestructive testing of insulation, including dielectric changes in Formex during intermittent aging and in composite structures, glass Formex and Teflon insulation, and Formex insulated motors during thermal aging are discussed. (J.A.G.)

1554

Naval Research Lab.
ENGINEERING PHYSICS OF DIELECTRICS. PROGRESS REPORT NO. 2. A. T. McClinton, Herbert Rabin, E. L. Brancato, R. S. Phillips, and C. R. Vail. Oct. 1, 1953. 62p. (NRL-Memo-218)

The installation and design of the Van de Graaff electron accelerator, the 2500-c Co^{60} source, various test cells, sample cans, and accessory equipment are reported. A film calibration of the Co source was performed. Instrumentation to measure high d-c resistances and a test to determine the decline in d-c resistance during irradiation of the magnet-wire-wound coils are discussed. A preliminary irradiation test of a vinylite sample was performed during which electrical properties were measured. The effects of varnish treatment on the life of Formex insulation of coils are reported. The coil tests were extended to motors and motorettes. A thermal-stability test of insulation materials is described. Instructions for Cd plating and chromating of motorette units are given. Nondestructive testing of insulation, including dielectric changes in Formex, glass-Formex, and Teflon insulation during thermal aging and changes in incipient ionization of insulation aging, is discussed. Design of a Quinn circuit and a NRL modified Quinn circuit for detection of ionization current and a micro ammeter circuit are given. The effects of repetitive voltage surge on the fatiguing or partial damage of dielectrics, including instrumentation design and calibration of a 360-kv, 135 w/sec impulse generator are discussed. (For preceding period see NRL-Memo-146.) (J.A.G.)

1555

Alabama Univ.
THERMAL EXPANSION OF SOME GLASSES IN THE SYSTEM OF $Li_2O-B_2O_3-SiO_2$. J. H. Handwerk and T. N. McVay. Nov. 1, 1954. 24p. Contract AT(40-1)-1080. (ORO-134)

The thermal expansions of several glasses in the system of $Li_2O-B_2O_3-SiO_2$ were investigated. The thermal expansion curves of these glasses are shown, and the coefficient of expansion factors for lithia, boric oxide, soda, and silica were calculated. These factors based on the lithia-boro-silicate glasses studied are somewhat different from the generally accepted factors as found in the literature. (auth)

1556

METHOD OF MEASURING INTERPHASE TENSION AT HIGH TEMPERATURES. S. I. Popel, O. A. Esin, and P. V. Gel'd. Translated from Doklady Akad. Nauk S.S.S.R. 74, 1097-1100(1950). 9p. Available from Henry Brutcher (Trans. No. 2769), Altadena, Calif. (AEC-tr-1321)

1557

NUMERICAL TABLES OF RELATIONS FREQUENTLY USED IN NUCLEAR EMULSION WORK. H. Fay, K. Gottstein, and K. Hain (Max-Planck-Institut fur Physik, Gottingen, Germany). Nuovo cimento Suppl. 11, No. 2, 234-63(1954) (In English)

Kinetic energy, relativistic factor, velocity, momentum, and the time necessary for the particle to come to rest are tabulated as a function of residual range in a nuclear emulsion for μ, π, τ mesons, protons, and hyperons. The tables are based on a new derivation of the range-energy relation for protons. The cell sizes for the mass determination of particles coming to rest in the emulsion are tabulated as a function of effective range for τ and π mesons and protons. (M.P.G.)

1558

AN INTERPRETATION FOR THE ELECTRONIC CONDUCTIVITY AND DIAMAGNETIC SUSCEPTIBILITY OF GRAPHITE. Kanetaka Ariyama and Shoichi Mase (Nagoya Univ., Japan). Progr. Theoret. Phys. (Japan) 12, 246-8 (1954) Aug.

1559

A PORTABLE VAN DE GRAAFF GENERATOR. T. R. Foord (Univ. of Glasgow, Scotland). J. Sci. Instr. 31, 440-1 (1954) Dec.

A simple and inexpensive air-insulated Van de Graaff generator is described which develops a maximum open-circuit voltage of approximately 200 kv and has a short-circuit current of 15 μa. (auth)

1560

ON THE THEORY OF LIQUID He^3. Louis Goldstein (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 96, 1455-60 (1954) Dec. 15.

The difficulties raised by the elementary interpretation of the recently observed temperature variation of the nuclear paramagnetic susceptibility of liquid He^3 as an ideal antisymmetric fluid type of degeneration phenomenon are discussed. The susceptibility data are then shown to lead to a direct and rigorous evaluation of the entropy of spin disorder and the associated heat capacity. The observed enormous total entropy of liquid He^3 at low temperatures is thus explained to be overwhelmingly entropy of spin disorder. The spin heat capacity is about half of the observed total heat capacity at the lowest temperature of observations. It should tend to become the dominant part of the total liquid heat capacity below this temperature. The maximum of the spin heat capacity at low enough temperatures may become observable indirectly through the total heat capacity of the liquid. (auth)

1561

HEAT AND ENTROPY OF MIXING OF He^3 AND He^4 ON THE BASIS OF THE TWO-FLUID THEORY OF He^4. O. K. Rice (Univ. of North Carolina, Chapel Hill). Phys. Rev. 96, 1464-5(1954) Dec. 15.

Recent data on the heat and entropy of mixing of He^3 and He^4 are treated by use of the two-fluid theory of He^4 together with Taconis' hypothesis that the He^3 dissolves only in normal fluid. Solution of He^3 causes normal fluid to be formed due to osmotic effects. It is assumed that the heat of mixing is a measure of the amount of normal fluid formed. It is then possible roughly to calculate the entropy of mixing of He^3 and He^4, taking into account entropy of mixing of He^3 and normal He^4, intrinsic entropy of the normal He^4 formed, and the entropy of mixing of normal and superfluid. This gives reasonable agreement with experiment. It is also shown that the theory indicates reasonably good fulfillment of the condition for internal equilibrium between normal and superfluid. (auth)

1562

SECONDARY EMISSION BY POSITIVE ION BOMBARDMENT. Manuel Schwartz and Paul L. Copeland (Illinois Inst. of Tech., Chicago). Phys. Rev. 96, 1466-9(1954) Dec. 15.

The investigation was undertaken primarily to determine the ratio of the secondary electron current to the primary ion current, i_s/i_p, for mercury ions bombarding a mercury target. The beam constituted a source of continually renewed surface of the target material. By varying the electron accelerating potential in the ion source, the proportions of the various types of ions present in the beam were altered. Thus the influence of mercury ions having different charges upon the secondary electron yield was determined. Some work was also done with cadmium ions bombarding a cadmium target. Singly charged mercury ions formed by electrons of up to 27 v in the ion source gave a secondary emission coefficient, γ, ranging from 1.2 percent at 4.2 kev to 4.8 percent at 9.2 kev. For electron accelerating potentials of 73 v, 110 v, and 430 v, ratios i_s/i_p were determined. At 430 v, i_s/i_p varied from 3.2 percent at 1.2 kv to 11 percent at 9.2 kv. Estimates were made of γ for Hg^{2+} and Hg^{3+} ions. In the case of cadmium, the electron accelerating potential was maintained at 450 v. Here i_s/i_p was exceedingly high for an untreated target, varying from 35 percent at 1.5 kv to 190 percent at 7.3 kv. Renewing the surface of the cadmium target by an additional source of cadmium vapor resulted in some reduction of i_s/i_p. (auth)

1563

ELECTRON CAPTURE AND LOSS BY MOVING IONS IN DENSE MEDIA. Jacob Neufeld (Oak Ridge National Lab., Tenn.). Phys. Rev. 96, 1470-8(1954) Dec. 15.

Several experiments have shown an anomaly in the stopping power which appears to be greater for incident heavy particles in condensed media than in gases. It is suggested that this anomaly is characteristic of incident ions, i.e., of particles that are not completely stripped of orbital electrons, and it seems to be due to the reaction of the perturbed medium upon the moving ion having charge Ze, which reaction results in a field $F = (1/Ze)\ (dW/dz)$ acting against the motion of the ion (dW/dz is the energy loss per cm). Although F is relatively weak in gases, it is substantial in condensed media and may cause the spontaneous emission of electrons carried by the ion (autoionization), thus increasing the ions' effective charge. The higher effective charge accounts for the higher stopping power in condensed media. It has been determined that when an incident helium atom passing through a liquid undergoes a collision, thus emerging in a singly ionized and excited state, it cannot exist in such a state since it becomes instantly doubly ionized. However, the same type of collision occurring in a gas leaves the atom singly ionized. The effective charge of the incident particle depends upon the values ϕ_0, ϕ_1, and ϕ_2, representing the probability of the particle's being neutral, singly ionized, and doubly ionized, respectively, where $\phi_0 : \phi_1 : \phi_2 = \sigma_{10}\sigma_{21} : \sigma_{01}\sigma_{21} : \sigma_{01}\sigma_{12}$ (σ_{if} represents the cross section for electron loss or capture; i and f represent the charge before and after the event, respectively). It is shown that σ_{if} is higher for a condensed medium than for a gas when $i < f$ and lower when $i > f$. σ_{if} has been calculated for He passing through argon gas at 400 kev, and gives roughly $\phi_0 : \phi_1 : \phi_2 = 0.05 : 0.75 : 0.20$; thus, an average square charge is $\langle\epsilon^2\rangle_{Av} = 1.55e^2$. If autoionization is taken into account, σ_{if} for He in liquid argon gives roughly $\phi_0 : \phi_1 : \phi_2 = 0.04 : 0.70 : 0.26$, and thus $\langle\epsilon^2\rangle_{Av} = 1.74e^2$. (auth)

1564

DETERMINATION OF THERMAL CONDUCTIVITIES AT HIGH TEMPERATURES. K. S. Krishnan and S. C. Jain (National Physical Lab. of India, New Delhi). Brit. J. Appl. Phys. 5, 426-30(1954) Dec.

The usual electrical methods of determining thermal conductivities either cannot be used at high temperatures or their use is restricted to substances like carbon or graphite which satisfy certain special requirements. It is shown that the observed temperature distribution along a metal filament electrically heated in a vacuum can be used for the determination of the thermal conductivity at high temperatures. The temperature distribution near the center of a short filament, which is known to be parabolic, or the distribution in regions slightly removed from the center of a long filament, which is known to be logarithmic, are particularly suitable for this purpose. Measurements are reported on the thermal conductivity of platinum in the temperature region 1300 to 1800°K made in this manner. (auth)

COSMIC RADIATION

1565

Institute for Industrial Research, Syracuse Univ.
ELECTRON PRODUCTION IN HIGH ENERGY NUCLEAR INTERACTIONS. Kurt Sitte, Fritz E. Froehlich, and Irving Nadelhaft. Mar. 24, 1954. 26p. Contract AT(30-1)-627. (NYO-6561)

An experiment was carried out at Echo Lake (altitude 3,260 m) and Mt. Evans (altitude 4,300 m), Colorado, in order to measure the dependence on the primary energy of the fractional energy transfer to the electronic component, in nuclear interactions of about 10 to 100 bev. Showers produced in a carbon block were grouped according to their multiplicity of penetrating particles as registered by a hodoscope, and the corresponding electron density was determined by a liquid scintillator placed under an appropriate lead shield. Since the shower multiplicity can be related to the primary energy, and the scintillator pulses can be calibrated by recording air showers, the number of electrons produced could thus be measured as a function of the primary energy. If, according to the Bristol data, in collisions around 50 bev primary energy, the production of K particles consumes a fraction of the primary energy equal to that given to the π mesons, and if π_0 decay is the only major contributor to the electronic cascade, one must expect a decrease of the fractional energy transfer to the electron component by about ½ between a maximum at 20 to 30 bev and a more constant lower level at 50 to 100 bev. This is not borne out by the experimental results which demonstrate a constant, or slightly increasing fractional transfer at energies above 20 bev. The results therefore indicate that a process or processes other than π_0 decay must be responsible for a considerable part of the electron component produced in collisions with primary energies above a few 10^{10}ev. (auth)

1566

THE RELATION BETWEEN COSMIC-BAY INTENSITIES AND HEIGHTS OF ISOBAR LEVELS. II. ON THE POSITIVE TEMPERATURE EFFECT. Masami Wada and Shoko Kudo. J. Sci. Research Inst. (Tokyo) 48, 245-59(1954) Dec.

The positive relation between the intensity of cosmic rays observed at sea level and the temperature at around 100 mb level is investigated. Existence of this relation and several suggestions such as those proposed by Trefall and Olbert for the interpretation of it are verified. These suggestions are, however, not enough for thorough explanation of the relation. Some remarks on ordinary barometer and temperature effects are also described. (auth)

1567

A STUDY OF SHOWER CURVES WITH THE MULTIPLATE CLOUD CHAMBER. K. Hinotani, K. Suga, and Y. Tanaka (Osaka Univ., Japan). J. Phys. Soc. Japan 9, 883-7(1954) Nov.-Dec.

Cosmic-ray cascade showers up to 800 Mev were examined by a multiplate cloud-chamber with respect to the shower curves and their fluctuation. The form of the shower curve is in good agreement with Wilson's Monte Carlo curve. The fluctuation in the number of shower particles seems to be of the Poisson type. From Shapiro's experiment and the authors', Wilson's results seem to be most reliable in both the absolute value and the form of the shower curve at least up to 800 Mev. (auth)

1568

STATISTICAL ESTIMATION OF THE EXPONENT OF THE SPECTRAL ENERGY OF PRIMARY COSMIC RADIATION. T. F. Joang, L. Jauneau, J. Jouvin, and C. Mabboux (Laboratorie de Physique de l'École Polytechnique, Paris, France). Nuovo cimento (9) 12, 869-74(1954) Dec. (In French)

The object of the present article is to use a statistical method on the basis of the maximum likelihood to estimate the exponent s of the power law E^{-s}, representing the integral energy spectrum of the primary cosmic radiation. The method has been applied successively to the primary protons observed from jets recorded in photographic emulsions and to the heavy primaries with $Z \geq 6$ published by Kaplon et al. Both results are consistent with the value of s not exceeding unity. Errors due to statistical fluctuations are large, a detailed discussion of which has been given. (auth)

1569

RECOIL TRACKS FROM NUCLEAR DISINTEGRATION STARS PRODUCED BY PROTONS OF DEFINITE ENERGY (50, 100, 150, 250, AND 450 Mev). M. Grilli and B. Vitale (Istituto di Fisica dell'Università, Padova, Italy), P. E. Hodgson (Univ. Coll., London, England), and M. Ladu (Istituto di Fisica dell'Università, Cagliari, Italy). Nuovo cimento (9) 12, 889-98(1954) Dec. (In Italian)

The results of measurements on the recoil tracks from nuclear disintegrations produced by protons accelerated to 50, 100, 150, 250 and 450 Mev are presented and compared with those predicted for primary protons of 400 Mev by a statistical analysis using the Montecarlo method. (auth)

1570

TIME VARIATIONS OF COSMIC RAY INTENSITY. F. Bachelet and A. M. Conforto (Istituto di Fisica dell'Università, Rome, Italy). Nuovo cimento (9) 12, 923-9(1954) Dec. (In English)

An apparatus for the continuous registration of the total ionization component of cosmic rays at sea level has been set up at Rome. The purpose is to study the correlations between cosmic ray intensity and atmospheric, geomagnetic and solar phenomena. The apparatus consists of telescopes of Geiger-Müller counters in triple coincidence, directed vertically, and inclined at 30° to the vertical in the direction south and north respectively. The difference between the diurnal variations in two inclined directions is considered free from atmospheric effects and is thus able to show up an anisotropy of the primary radiation. There are four independent telescopes in each direction, with a total of about 27,000 coinc./h in north and south directions respectively, and about 48,000 coinc./h in the vertical. The counters are held thermostatically at 30 ± 1 °C. The methods used to reduce the instrumental inequalities and to obtain the maximum operational stability and continuity are described. The preliminary results obtained in the first counting period, from January to March 1954, are presented. (auth)

1571

ON THE SPECTRUM OF THE PHOTON COMPONENT IN THE LOWER ATMOSPHERE. C. Cernigoi and G. Poiani (Istituto di Fisica dell'Università, Trieste, Italy). Nuovo cimento (9) 12, 957-8(1954) Dec. (In Italian)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1572

A CONTINUOUSLY RECORDING ELECTRON DIFFRACTION CAMERA FOR STUDIES OF CRYSTAL STRUCTURE TRANSITIONS. A. Boettcher, R. Thun, and H. Trevoel (Degussa, Hanau, Germany). Acta Met. 2, 743-51(1954) Nov. (In German)

A new electron diffraction camera for investigating rapidly proceeding lattice transitions is described. The outstanding new features of the apparatus are a screen with a slit diaphragm and a photoplate which moves behind the slit. The moving photoplate is exposed by the direct electron beam and by two small portions of each diffraction ring. The resulting pattern consists of parallel lines instead of rings. The new method permits the continuous recording of both structure transformations and the distribution of different crystalline components over an extended flat sample. Various applications for which the method is particularly valuable are presented. (auth)

ELECTRICAL DISCHARGE

1573

ELECTROACOUSTICAL WAVES IN GAS-DISCHARGE PLASMA. M. V. Konyukov and Ya. P. Terletskii. Zhur. Ekspt'. i Teoret. Fiz. 27, 542-8(1954) Nov. (In Russian)

1574

ON CERTAIN PROPERTIES OF A SLIGHTLY NONIDEAL ELECTRON GAS. G. E. Zil'berman. Zhur. Ekspt'. i Teoret. Fiz. 27, 549-56(1954) Nov. (In Russian)

ELECTRONS

1575

INTERACTION OF ELECTRONS WITH MATTER. Ch. A. d'Andlau (Laboratoire de Physique de l'École Polytechnique, Pairs, France). Nuovo cimento (9) 12, 859-68(1954) Dec.

The interaction of electrons with matter was experimentally investigated with a single-plate Wilson chamber placed in a magnetic field at sea level. This experiment permitted a study of the incident electron and the number and energy of shower electrons produced in the plate. The experimental results are compared with the results of shower theory. (tr-auth)

GASES

1576

ON THE PERFECT GAS AND THE EQUATION OF STATE OF REAL GASES. Yasuo Mori. J. Sci. Research Inst. (Tokyo) 48, 272-9(1954) Dec.

The perfect gas is proved to be defined as the gas of zero radius of molecule by theoretical and experimental analyses. Properties of real gases at zero pressure are shown not always to coincide with those of the perfect gas except with reference to the equation of state, and the relations between real gases and the perfect gas are discussed. An empirical equation of state of a real gas is reasonably shown to have to be of the virial expansion type. (auth)

1577

DIFFUSION OF GASES THROUGH NICKEL AND DESIGN OF A CONVENIENT LEAK FOR HYDROGEN AND DEUTERIUM. K. Landecker and A. J. Gray (Univ. of Sydney, Australia). Rev. Sci. Instr. 25, 1151-3(1954) Dec.

The diffusion of gases through thin-walled nickel tubing (cathode tubing) has been investigated in the temperature range 200 to 1000°C. It was found that at the most thoroughly examined temperature of 500°C and at a pressure difference of 1 atm., hydrogen and deuterium diffuse through this tubing about 2000 times faster than any of the other gases tried. The design of a hydrogen and deuterium leak is described which is easy to construct and to operate. The tubing does not appear to deteriorate because of crystallization as is experienced with palladium tubing. (auth)

INSTRUMENTS

1578

Arkansas Univ. Engineering Experiment Station

DEVELOPMENT OF AN INSTRUMENT FOR THE INSTANTANEOUS ANALYSIS OF GAS MIXTURES. QUARTERLY PROGRESS REPORT NO. 8 [FOR] OCTOBER 10, 1953 TO DECEMBER 31, 1953. Feb. 28, 1954. 20p. Contract AF33(616)-15. (AD-32604)

Progress is reported in the development of a mass spectrometer designed for the instantaneous analysis of gas mixtures. Data are presented on the design and performance of one stage r-f mass spectrometer tubes. Results of tests indicate that the resolution of the tube is sufficient to detect helium in the presence of air without interference from the air; the collector plate current can be used to measure the concentration of helium in air, and the pulling out grid current is directly proportional to the pressure in the tube and can be used to measure the pressure of the system to which the tube is attached. Test results indicate the feasibility of developing a r-f mass spectrometer with a one stage analyzer into a satisfactory leak detector and ion gage requiring a minimum amount of circuitry. (C.H.)

1579

Arkansas Univ. Engineering Experiment Station
DEVELOPMENT OF AN INSTRUMENT FOR THE INSTANTANEOUS ANALYSIS OF GAS MIXTURES. QUARTERLY PROGRESS REPORT NO. 9 [FOR] JANUARY 1, 1954 TO MARCH 31, 1954. APPENDIX A. HIGHLY REGULATED R. F. VOLTAGE SUPPLY. L. G. Sloan, R. W. Raible, and M. K. Testerman. APPENDIX B. A COMPACT VACUUM ION-GAUGE SUPPLY, METER, AND PROTECTOR. R. W. Raible and M. K. Testerman. May 17, 1954. 24p. Contract AF33(616)-15. (AD-32605)

Progress is reported in the development of a mass spectrometer designed for the instantaneous analysis of gas mixtures. Design of a five-stage metal mass spectrometer tube is discussed. All circuits used in conjunction with the r-f mass spectrometer were critically reviewed and design changes are discussed. Data on the design and performance of a compact oscillator capable of producing a stable r-f voltage over long periods of time and design and performance of a compact but versatile ion gage supply, in which is incorporated a vacuum-tube voltmeter for ion current measurements and an automatic protector circuit, as well as an emission regulator for the filament are appended. (For preceding period see AD-32604.) (C.H.)

1580

David Sarnoff Research Center
ELECTRONIC DEVICES FOR NUCLEAR PHYSICS. QUARTERLY REPORT NO. 17, AUGUST 1, 1954—OCTOBER 31, 1954. R. H. Anderson, M. H. Greenblatt, and A. H. Sommer. (This report also covers work on photoelectric emission which is not included in the contract, and was done by: A. L. Solomon and A. H. Sommer.) Dec. 16, 1954. 19p. For [Oak Ridge National Lab.]. Contract W-7405-eng-26, Subcontract 308. (AECU-2980)

Progress is reported on studies aimed at the improvement of photomultipliers for scintillation counting. Data are presented from an investigation of semiconductor characteristics of photoemitters; investigations on semiconductor base material; performance of $(KNa)_2Sb$ as a photocathode; modifications in type H-6687 photomultiplier tubes to increase current output; the performance of an experimental 9-in. photomultiplier tube; and development of a high-speed multiplier tube. (For preceding period see AECU-2949.) (C.H.)

1581

Defence Research Northern Lab. (Canada)
A PORTABLE POTENTIOMETER FOR MEASURING THE EMF's OF THERMOCOUPLES. E. A. L. Lytle. Jan. 1954. 9p. (DRNL-TP-22)

A null balance portable potentiometer for the rapid measurement of temperature is described, employing a mercury battery as a standard cell and thermistors to compensate for change of component values with ambient temperature. The desired accuracy of ± 1°C for a temperature measuring range of -40°C to 110°C for ambient temperatures from -40°C to 25°C is obtainable. (auth)

1582

Knolls Atomic Power Lab.
ANALYSIS OF SINGLE LOOP CURRENT FEED-BACK AMPLIFIERS. Richard S. Stone. Nov. 4, 1954. 26p. Contract W-31-109-Eng-52. (KAPL-1243)

A detailed description is presented of the design process for single loop amplifiers. The loop stability criterion is illustrated. The amplifier and the feed-back transfer functions are derived. A unique behavior due to Miller effect in triode amplifiers is considered. (auth)

1583

A HIGH FREQUENCY ION SOURCE. Miomir B. Nikolić and Milivoj U. Crnilović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 29-41(1953) Aug.

Some investigations on a high-frequency ion source with superposed permanent magnetic field, perpendicular to the alternating one and to the source axis, are reported. The greatest part of this investigation was performed to obtain a high ion current and high power percentage. For this purpose a suitable apparatus was constructed which made it possible to easily modify all details in order to obtain the best operating conditions. With permanent magnetic field in the vicinity of the extracting electrode and by excitation of the source with a 60-Mc and 400-w (input power) oscillator, a proton current of 1.1ma for a pressure of about 10^{-2} mm Hg was obtained. This current was measured on the target at a distance of one meter from the source after an acceleration of 50 kv and a magnetic beam analysis. The proton percentage was over 80%, which was also shown by the intense red color of the plasma. Some phenomena were observed, due to an influence of the plasma on the oscillator, in the presence of the permanent magnetic field. This occurs by a critical excitation of the oscillator tube grid. Two different states in the plasma with an intermittent passage from one to the other were observed at a certain interval of pressure. This intermittence appears by greater oscillator's grid feed-back. In presence of the permanent magnetic field a resonance phenomenon appears. The intensity of the plasma luminosity as a function of the stimulating power was measured with a photocell by different feed-backs of the oscillator grid and in the presence of the optimal permanent magnetic field. (auth)

1584

A 100 AMPERE DIRECT CURRENT SERVOSTABILIZER. Miodrag M. Novaković. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 61-8(1953) Aug.

A 100-amp d-c supply is stabilized by employing a closed loop stabilization with two channels for slow changes of input voltage up to 27% of nominal voltage and for fast changes of less than 25% of nominal supply voltage. By this method the output current is stabilized within a maximum variation of 0.05% of the nominal output current. (auth)

1585

A 50 CHANNEL AMPLITUDE ANALYSER. Fedor M. Borelli. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 83-93(1953) Aug.

A 50-channel analyzer of the Wilkinson type (Proc. Cambridge Phil. Soc. 46, 508(1950)) is described. The output stage is modified to improve counting rate. On a specially constructed register one can directly observe the growing of the spectrum. (auth)

1586

ISOTHERMAL JACKET MICROCALORIMETER FOR HEAT EFFECTS OF LONG DURATION. Paul Gordon (Univ. of Chicago, Ill.). Rev. Sci. Instr. 25, 1173-7(1954) Dec.

A Borelius type isothermal jacket microcalorimeter has been designed and constructed. It consists essentially of a vapor thermostat providing a constant temperature environment about a chamber containing the specimen and measuring device, the latter being a high-sensitivity differential thermopile. With one set of thermopile junctions kept at constant temperature by contact with the environment, and the other set arranged to vary in temperature with the specimen, a heat effect in the specimen is measured by following the difference in temperature across the thermopile as a function of time. Calibration of the apparatus is carried out by using the Peltier heat developed at the junction of a thermocouple located in an axial hole in the specimen. With an argon atmosphere in the specimen chamber, the limit of detection is a heat flow of 0.003 gram-calories per hour. The absolute accuracy of the determinations depends upon the particular conditions of a given run, but is usually in the vicinity of 2 to 5 percent. (auth)

1587

HIGH-INTENSITY ION SOURCE. C. B. Mills and C. F. Barnett (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 25, 1200-2(1954) Dec.

An ion source that does not require a filament has been developed for use in the cyclotron. Positive ions, from an oscillatory region within a hollow anode, bombard the cathodes at the ends and maintain them at emission temperatures. The source aperture is a lateral slit, $^3/_{32} \times 2^1/_4$ in., in the wall of the anode. With a 10 kv (dc) accelerating potential, stable hydrogen ion beams of 330 ma (82 percent protons) have been obtained. Ion output increases as hydrogen gas feed is increased from 1 to 12 cc/min (N.T.P.). The average proton production efficiency has been 20 percent. (auth)

1588

EFFECT OF FEEDBACK ON NOISE IN A PULSE AMPLIFIER. Robert L. Chase (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 25, 1219(1954) Dec.

An error in an article entitled "A Minimal Noise Preamplifier for Proportional Counters and Similar Application" by K. Enslein and B. Brainerd (Rev. Sci. Instr. 24, 916(1953)) is reported. In the above paper it is claimed that the noise contribution of the second stage is unimportant because that stage is inside the feedback loop and its contribution is attenuated by the feedback factor. In the present paper the author demonstrates that in a negative feedback amplifier, as in any amplifier, the second stage noise contribution is less than that of the first stage by just the gain factor of the first stage. (L.T.W.)

1589

A SIMPLE MICROSCOPE ATTACHMENT FOR OBSERVING HIGH-TEMPERATURE PHENOMENA. J. H. Welch (Building Research Station, Watford, Herts, England). J. Sci. Instr. 31, 458-62(1954) Dec.

The apparatus consists of a small, electrically heated thermocouple bent into a loop at its extremity so as to hold the specimen, in the form of a bead, in contact with the thermojunction. For convenience, the bead is normally observed through a 25 mm microscope objective, though a 16 mm objective (5 mm working distance) can be used without any special precautions. The heating current is taken from any convenient 50 cps supply, and a vibrating switch driven from the same supply permits the heating current to flow only during alternate half cycles, the measuring circuit being employed during the intermediate half-cycles. The power dissipated by the heater at maximum temperature (1750°C) is only about 6 w. The apparatus gives extremely rapid results in comparison with normal techniques when put to such uses as melting-point determinations, studies of glass devitrification, growing single crystals for x-ray structure determinations, and delineation of phase equilibria; it should find widespread application in the fields of glass and ceramic technology. (auth)

ISOTOPES

1590

Columbia Univ.
CONTRIBUTION TO THE PROBLEM OF NATURALLY OCCURRING TECHNETIUM. Edward A. Alperovitch. Feb. 4, 1954. 118p. Contract AT(30-1)-1019. (NYO-6139; CU-15-54-AEC-1019-Chem.)

Conflicting information about the existence of Tc in nature is reviewed, and the need for further experimental evidence regarding its terrestrial occurrence shown. The original cosmic abundance ratios Tc^{97}/Re and Tc^{98}/Re are estimated to be in the order of 1:1 and 1:10, respectively. Of three available methods of detection: emission spectroscopy, mass spectrometry, and neutron activation, only the last two are found to be of sufficiently high sensitivity and specificity to permit the detection of 10^{-10} to 10^{-18} g of Tc per gram of material. A chemical procedure for the isolation of Tc from natural sources, giving decontamination factors of 10^{10} from Re, Mo, and most other elements, is shown to be a prerequisite for the application of these methods. A procedure meeting these requirements is developed by a combination of distillation and anion-exchange chromatographic techniques. Of six minerals examined by neutron activation for naturally occurring Tc^{98}, two yttrotantalites and a columbite gave positive results, indicating a Tc^{98} content of 10^{-9} to 10^{-15} g/g, and 10^{-10} to 10^{-16} g/g, respectively. Since no Tc^{97} was found in 3 pre-Cambrian molybdenites, the half life for the β decay of Mo^{97} must be $> 2.4 \times 10^{16}$ years. (auth)

ISOTOPE SEPARATION

1591

Oak Ridge National Lab., Y-12 Area
THE ELECTROMAGNETIC CONCENTRATION OF GALLIUM-69 AND 71. W. A. Bell and L. O. Love. July 14, 1950. Decl. Oct. 5, 1954. 22p. Contract W-7405-eng-26. (Y-628)

Gallium was processed in the calutron to produce enrichment of the Ga^{69} and Ga^{71} isotopes. $Gallium^{71}$ (natural abundance 39.8%) was enriched to 98.08%. (auth)

1592

Oak Ridge National Lab., Y-12 Area
THE ELECTROMAGNETIC CONCENTRATION OF LEAD. H. J. Buttram, W. A. Bell, and L. O. Love. Oct. 5, 1950. Decl. Oct. 6, 1954. 23p. Contract W-7405-eng-26. (Y-669)

Lead was processed in the calutron to produce enrichment of all four of its stable isotopes. (auth)

1593

Oak Ridge National Lab., Y-12 Area
THE ELECTROMAGNETIC CONCENTRATION OF THE ISOTOPES OF STRONTIUM. W. A. Bell, H. J. Buttram, and L. O. Love. Nov. 22, 1950. Decl. Oct. 5, 1954. 18p. Contract W-7405-eng-26. (Y-692)

Strontium was processed in the calutron to produce samples enriched in isotopic abundance. A brief discussion of charge materials and equipment is given. Production is evaluated on the basis of charges used and samples produced. (auth)

1594

THE EFFECT OF NITRATE-ION AMMONIA ON THE ELECTROLYTICAL SEPARATION OF HYDROGEN-DEUTERIUM ISOTOPES. Jolanda M. Hojman. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 121-6(1953) Aug.

In investigating the effect of nitrate ion and of ammonia on the electrolytic process for obtaining heavy water, it was found that by electrochemical oxidation of ammonia a small increase in the separation factor may be realized. Nitrate ion does not affect the separation even with a polarized electrode. The separation factor, however, decreases if the passage of molecular hydrogen through the electrolyte is prolonged. (auth)

MASS SPECTROGRAPHY

1595

IMPROVED MASS SPECTROMETER ION SOURCE FOR THE ANALYSIS OF SOLIDS. J. D. Louw and J. W. L. De Villiers (South African Council for Scientific and Industrial Research, Pretoria). Rev. Sci. Instr. 25, 1226-7(1954) Dec.

A mass spectrometer ion source for the study of solids as described by Nier (Rev. Sci. Instr. 18, 398(1947)) was found to exhibit some undesirable characteristics. Among others was the difficulty in obtaining the same resolution after demounting and reassembling of the ion source, while the optimum resolution setting during an analysis could not be maintained because of uneven expansion of the heated parts. Also, the resolution was usually inadequate for analysis in the mass range 190 to 210. A more rigid construction for the ion source to overcome these difficulties is reported. (L.T.W.)

MATHEMATICS

1596

DuPont de Nemours, E. I., and Co. Explosives Dept. Atomic Energy Div.
MACHINE COMPUTATION OF BESSEL FUNCTIONS. J. C. English. Nov. 1954. 22p. Contract AT(07-2)-1. (DP-93)

Details are given for wiring the electronic calculator panel of the IBM Card Programmed Calculator to yield the Bessel functions $I_n(x)$ and $K_n(x)$ for $n = 0, 1, 2,$ and 3. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

1597

Brookhaven National Lab.
γ-RAY SPECTROSCOPE USING A SCINTILLATING CRYSTAL. R. Sternheimer. Oct. 11, 1951. 12p. (AECU-2982)

Results are reported from an investigation of scintillation crystals for use in a γ-ray spectrometer. Data are presented on the properties and the probabilities of scattering for a NaI cylindrical crystal, for an arrangement consisting of thin parallel cylindrical lead plates between which there are thin layers of scintillating liquid, and for plates of lead glass with layers of scintillating liquid between successive plates. (C.H.)

1598

DuPont de Nemours, E. I., and Co. Explosives Dept. Atomic Energy Div.
A SURVEY METER FOR URANIUM AND PLUTONIUM. A. H. Dexter. Nov. 1954. 23p. Contract AT(07-2)-1. (DP-62)

A survey meter was developed to distinguish plutonium contamination from uranium. The instrument consists of an alpha counter with a very shallow sensitive depth and a means for accurately positioning the alpha counter relative to the source of contamination. Since the alpha particles emitted by plutonium have a greater range in air than those emitted by uranium, the instrument can identify the contaminant by measuring the range of alpha particles which are emitted. The survey meter is a self-contained portable instrument which operates on 110 v a-c. (auth)

1599

Ames Lab.
SOME CHARACTERISTICS OF A GRIDDED PARALLEL-PLATE IONIZATION CHAMBER. Lloyd O. Herwig, Glenn H. Miller, and Nyle G. Utterback. [Feb. 3, 1954]. 34p. Contract [W-7405-eng-82]. (ISC-454)

Studies have been made of effects encountered in the use of a gridded parallel-plate ion chamber for energy measurements. These effects are: gas multiplication about the grid structure, capture of electrons by the grid, and variation of saturation characteristics between various gases and gas mixtures. Curves relating to these are presented for He, Ne, A, Kr, N_2, He + 3% CO_2, A + 3% CO_2, and A + 5% N_2. It is found that the field conditions necessary to prevent electron capture by the grid may be correlated with electron lateral diffusion. Anomalies in connection with the behavior of argon$-CO_2$ mixtures are pointed out, and several possible explanations for these are discussed. (auth)

1600

Los Alamos Scientific Lab.
ARGON TREATMENT OF LIQUID SCINTILLATORS TO ELIMINATE OXYGEN QUENCHING. Donald G. Ott, F[rancis] Newton Hayes, Jay E. Hammel, and John Kephart. Oct. 1954. 6p. Contract W-7405-eng-36. (LA-1837)

A careful study of small-volume liquid scintillators has indicated an increase in pulse height of 23 per cent when dissolved oxygen is removed by bubbling the solution with argon; similar improvement was noted for two solutions in a detector of 60-l volume. Oxygen quenching appears to be independent of the type of solvent or solute. The best liquid solution scintillator has a pulse height after argon bubbling of 1.36 relative to the best plastic scintillator and a pulse height relative to anthracene of 0.70. (auth)

1601

Naval Research Lab.
NEUTRON-DETECTING PHOSPHORS. J. I. Hoover and C. F. Dohne. Jan. 20, 1954. 22p. (NRL-4453)

Phosphors containing elements having a high probability of interaction with neutrons have been investigated as neutron detectors. The reactions considered were the

Li^6(n,α), B^{10}(n,α), (n,p) with hydrogen, and U (n,f). None of the phosphors considered were superior to existing methods of detection. (auth)

1602

Naval Research Lab.

A SHALLOW-WELL GAMMA CALIBRATION RANGE. A. E. Nash, H. M. Childers, and J. D. Graves. Dec. 13, 1954. 13p. (NRL-4459)

A shallow-well type gamma irradiation range has been constructed for the calibration of integral-dose type radiation detectors. Provision is made for the simultaneous exposure of up to 72 detectors within the relatively compact (64 by 64 by 70 inches over-all) range. The principal feature of the device is remote manipulation of the sources by the vacuum lift method which affords maximum operating personnel protection. Means are also provided for preventing mechanical damage to the sources employed in this equipment. Standard calibration procedures were used to measure the roentgen field intensities from sources of Co^{60}, Cs^{137}, and Ra, within the range. A method was developed for estimating the amount of scattering in a closed configuration of this type, and scattering was found by this method to be negligible except at points very near the wall of the range. (auth)

1603

IMPROVEMENT IN RUBBER CLOUD-CHAMBER TECHNIQUE. H. Blumenfeld, E. T. Booth, and L. M. Lederman (Columbia Univ., New York, and Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 25, 1220(1954) Dec.

It is standard practice with rubber diaphragm expansion cloud chambers to employ a velvet baffle which serves to damp the gas motion and reduce turbulent distortion of tracks. The resistance offered by the velvet makes necessary the production of a higher supersaturation ratio behind the velvet. This overexpansion may, in cases of thick velvet and high ionization levels, produce very high fog density behind the velvet. In the present paper the performance of a clearing field electrode between the velvet grid and rubber diaphragm in disposing of the fog is reported. (L.T.W.)

1604

ROENTGEN DOSE MEASUREMENTS ON A RADIATION OF VERY HIGH INTENSITY. Bo Lindell (King Gustaf V Jubilee Clinic, Stockholm, Sweden). Acta Radiol. 42, 398-410(1954) Nov.

A survey is given of the possibilities of determining the ionization losses caused by ion recombination in thimble chambers irradiated with x rays of very high intensity. Dose measurements have been made, and saturation curves are shown illustrating the performance of two common types of chambers irradiated with short x-ray pulses from a discharge tube. In a small volume it is possible to deliver with the tube x-ray doses up to 1,000 r with dose rates up to 10^7 r/sec, the pulse duration being shorter than 100 μsec. It is shown that, even at these high dose rates, the saturation in the chambers can easily be determined by help of the common formulas used at moderate dose rates. A method is suggested for calculating the real dose, when the dose rate is not known sufficiently well to permit a direct estimation of the correction that should be applied to the measured values because of the ion recombination. (auth)

1605

LOW ENERGY MEASUREMENTS WITH THE PHOTOMULTIPLIER SCINTILLATION COUNTER. G. T. Wright (Rhodes Univ., Grahamstown, South Africa). J. Sci. Instr. 31, 462-5(1954) Dec.

The method of statistical generating functions is used to investigate the process of cascade multiplication. The equations developed are used to examine the nature of the pulse-height distribution curve from the scintillation counter and to evaluate the counting efficiency of this instrument. It is found that the maximum of the distribution may be displaced considerably from the position of the mean and curves are drawn to illustrate this. The effects of non-uniform photocathode and dynode surfaces are investigated and it is concluded that these have little influence compared with the normal statistical processes. (auth)

1606

RESPONSE OF NaI(Tl), KI(Tl), AND STILBENE TO FISSION FRAGMENTS. J. C. D. Milton and J. S. Fraser (Atomic Energy of Canada Ltd., Chalk River, Ontario). Phys. Rev. 96, 1508-11(1954) Dec. 15.

The scintillations produced in NaI(Tl), KI(Tl), and stilbene by fission fragments are found to be about twice as large as those produced by 5-Mev alpha particles. The superior resolution of the inorganic crystals clearly separates the light and heavy fragment groups. The larger scintillations are associated with the more energetic light-fragment group. The pulse height as a function of residual range was measured for both groups in KI(Tl), whence it was found that at large values of the specific energy loss the specific fluorescence again increases rapidly. (auth)

1607

ČERENKOV RADIATION DETECTOR FOR THE SELECTION OF SLOW PARTICLES. Carl M. York, Jr. (California Inst. of Tech., Pasadena). Phys. Rev. 96, 1635-7 (1954) Dec. 15.

A cloud chamber in a magnetic field has been operated at an altitude of 1750 m. The chamber was triggered by a slow-particle selector which utilizes the properties of the Cherenkov radiation. An analysis of 1142 picutres is presented, and one possible example of the nuclear capture of a K$^-$ particle is discussed in detail. (auth)

1608

AN ANALYSIS OF EFFICIENCY OF MICA-WINDOW GM COUNTERS AS A FUNCTION OF ELECTRODE GEOMETRY. Miodrag M. Petrović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 19-22(1953) Aug.

After a study of the electrode geometry, a counter was constructed with a definite and invariable effective space. The slope of the plateau of the new counter does not change with the position of the source; furthermore, it is smaller than in previous counters. For the same window surface the counter has a greater efficiency and is electrostatically shielded so that its sensitivity to electric disturbances and photoeffects is decreased. (auth)

1609

SOME IMPROVEMENTS OF THE CONTINUOUS DIFFUSION CLOUD CHAMBER METHOD. Aleksandar B. Milojević, Miho A. Cerineo, and Branislav I. Lalović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 23-7(1953) Aug.

By using liquid air as the means for cooling the bottom plate of a diffusion cloud chamber, very steady working conditions can be obtained. Moreover, the experiments performed showed very definitely that such a chamber, because of the discrimination effect, could be successfully used in all experiments in which heavy particles are to be recorded. The discrimination effect offers the possibility to use a multiplier for automatic triggering of the photographic system, whenever an event happens in which heavy particles are emitted. More concretely, such an improved diffusion cloud chamber can also be used in the spectrography of neutrons. (auth)

1610

A LONG LENS BETA RAY SPECTROMETER. Milorad S. Mladenović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 69-73(1953) Aug.

A description is given of an iron-free long-lens beta spectrometer and an electron gun with two hemispherical electrodes which was used for the adjustment for the spectrometer. For a source of 2 mm diameter and a solid angle of 1.4% of 4π, the resolving power of the spectrometer is 0.46%. (auth)

1611

A DEVICE FOR MEASURING PULSE SPECTRA. Slobodan D. Muždeka. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 75-81(1953) Aug.

A device for registering ionization pulses is described. The device employs an ionization chamber or proportional counter, and the pulse, proportional to the energy of the particle, is amplified by a linear amplifier and can be registered by the accessory magnetic or cathode-ray oscillograph. (L.T.W.)

1612

TIME ANALYSIS OF WILSON CLOUD CHAMBER EXPANSIONS. Aleksandar B. Milojević. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 95-102(1953) Aug.

To get a more precise time analysis of the Wilson cloud chamber expansions, characteristics of a high-speed electromagnetic value are investigated, and a method is developed for the direct measurements of the speed of the expansion. (auth)

1613

A NEW MATERIAL AND TECHNIQUES FOR THE FABRICATION AND MEASUREMENT OF VERY THIN FILMS FOR USE IN 4π-COUNTING. B. D. Pate and L. Yaffe (McGill Univ., Montreal, Quebec, Canada). Can. J. Chem. 33, 15-23 (1955) Jan.

A new method for preparing thin films for use in beta spectrometry and 4π counting is described. These films, made of polyvinylchloride-acetate copolymer are readily prepared with superficial densities as low as 1 μg per cm^2. The films have good tensile strength and show excellent resistance to acids, alkalies, and many organic reagents. The thickness of the films may be determined gravimetrically, radiometrically, and optically either by transmission or reflection. The films can be made conducting by distilling a thin gold layer on to them. The thickness of the gold layer can be determined spectrophotometrically. (auth)

1614

LUMINESCENCE WITH PARTICULAR REFERENCE TO INORGANIC PHOSPHORS. A symposium held by the Electronics Group of The Institute of Physics at the Cavendish Lab., Cambridge, from the 7 to 10 April, 1954. Brit. J. Appl. Phys. Suppl. No. 4, 1955. 127p.

A group of 21 papers covering a wide range of scientific and industrial applications of luminescent materials and phosphors is collected for convenient reference. Particular properties of a large number of phosphors are discussed. Several papers are included which cover a number of theoretical problems of current interest in analyzing the luminescence process. A paper on electroluminescence in 3 organic compounds is included, although emphasis is placed upon solid inorganic phosphors. (K.S.)

1615

BETA SPECTROMETER WITH HIGH COLLECTING POWER. G. Bolla, S. Terrani, and L. Zappa (Istituto di Fisica Sperimentale del Politecnico, Milan, Italy). Nuovo cimento (9) 12, 875-83(1954) Dec. (In Italian)

An intermediate-image type Slätis-Siegbahn beta spectrometer is described. Focussing experiments and some spectra are reported. (auth)

1616

ON A NEW METHOD FOR PRECISE COMPARISON OF RADIATION FROM AMPOULES OF RADIUM. Irène Curie (Laboratoire Curie de l'Institut du Radium). J. phys. radium 15, 790-5(1954) Dec. (In French)

The compensation method between currents produced in two ionization chambers adapts itself to very high precision measurements between radiation sources of nearly equal intensity. By the use of an ampoule of Rn, whose decay is precisely known, as an auxiliary standard, the method can be adapted to the comparison of radiation from Ra ampoules of different intensities. The ionization chamber design is discussed, together with preliminary experiments. The use of Rn ampoules as the auxiliary standard is sometimes of interest in the case of measurements made with a single ionization chamber or with other measuring equipment. (tr-auth)

1617

PROPERTIES AND APPLICATIONS OF PHOTOELECTRIC CELLS TO ELECTRON MULTIPLIERS. M. F. Lenouvel (Agrégé de l'Université, Astronome à l'Observatoire de Haute-Provence). J. phys. radium 15, 64S-5S(1954) Dec. (In French)

1618

A PRECISION GAUSSMETER FOR NUCLEAR RESONANCE. D. Dautreppe and J. Paulevé (Laboratoire d'Électrostatique et de Physique du Métal). J. phys. radium 15, 78S-9S(1954) Dec. (In French)

1619

ABERRATIONS AND RESOLVING POWER OF MAGNETIC SPECTROGRAPHS FOR DOUBLY FOCUSED β RAYS. J. B. Bellicard and A. Moussa. J. phys. radium 15, 79S(1954) Dec. (In French)

1620

RADIOCARBON DATING SYSTEM. G. J. Fergusson (Dominion Physical Lab., Lower Hutt, New Zealand). Nucleonics 13, No. 1, 18-23(1955) Jan.

An improved system for radiocarbon dating is described in detail. The equipment includes a well-shielded 7.7 liter proportional counter, electronic equipment for analyzing output pulse heights, and a surrounding ring of G-M counters to identify cosmic-ray background. The maximum age that can be measured for a 1-day count on a sample is 35,000 yr for a counter-filling pressure of 1 atm. and 42,000 yr for 3 atm. An accuracy of 0.3% is possible in contemporary C^{14} assay. (M.P.G.)

MESONS

1621

EFFECT OF THE PAULI MOMENT ON THE γ-DECAY OF NEUTRAL MESON. Hiroshi Katsumori (Osaka Gakugei Univ., Japan). Progr. Theoret. Phys. (Japan) 12, 241-3 (1954) Aug.

The discrepancy between the observed mean life for γ decay of the neutral meson (10^{-14} sec) and the theoretical value (7.1×10^{-16} sec) determined from PS fields, PS coupling is examined. The effect of an additive interaction term due to the Pauli moment is evaluated. Schwinger's proper time method is used, and it is found that such considerations lead to a mean life $\leq 10^2$ longer. (K. S.)

1622

Λ^0 EXCITED STATE. D. C. Peaslee (Purdue Univ., Lafayette, Ind.). Nuovo cimento (9) 12, 943-4(1954) Dec. (In English)

Among charged hyperon decays the best-supported experimentally appear to be (1) $\Lambda^- \rightarrow \pi^- + \Lambda^0 + Q_1$, Q_1, ~ 60 MeV (2) $Y^\pm \rightarrow \pi^\pm + n + Q_2$ and $Y^+ \rightarrow \pi^0 + p + Q_2$, $Q_2 \sim 120$ MeV. The decay (1) is in accord with a general scheme of V particles. The present note suggests that decay (2) is most readily incorporated into this scheme by taking the $Y^\pm$ to be an excited state of the Λ^0. It is of the same generic type as the Λ^0, being a fermion with integer isotopic spin and charge number t_z. The ground state of the Λ^0 has $t = 0$, and the excited state Y evidently has $t = 1$. The excitation energy is $(Y - \Lambda^0) = Q_2 - Q_0 = 120 - 37 \approx 85$ MeV, so that the $Y^\pm$ states cannot decay to Λ^0 by rapid emission of a π; they must decay to a nucleon plus π by a weak interaction of the same sort that induces Λ^0 decay. The state Y^0 does not have this metastability, since it decays to Λ^0 by rapid γ emission. (auth)

1623

ON A SYSTEMATIZATION OF HEAVY MESONS AND HYPERONS. J. Rayski (Nicholas Copernicus University, Torun, Poland). Nuovo cimento (9) 12, 945-7(1954) Dec. (In English).

1624

A NEGATIVE HYPERON DECAYING IN FLIGHT. A. Debenedetti, C. M. Garelli, L. Tallone, and M. Vigone (Istituto di Fisica dell'Università, Turin, Italy). Nuovo cimento (9) 12, 952-3(1954) Dec. (In English)

An example of a negative hyperon decaying in flight has been observed in a nuclear emulsion. The event has been found during the regular scanning of a plate flown at 80,000 ft. From a star of the type 11 + 14 α is emitted a grey track which travels 927 μ; a track of lower ionization occurs, which, after 16,590 μ comes to rest and gives rise to a σ star. (auth)

1625

ON NARROW SHOWERS OF PAIRS OF CHARGED PARTICLES. A. Debenedetti, C. M. Garelli, L. Tallone, M. Vigone, and G. Wataghin (Istituto di Fisica dell'Università, Turin, Italy). Nuovo cimento (9) 12, 954-6(1954) Dec. (In English)

The purpose of the present note is to make a preliminary report on two high-energy events of pair production observed in a stack of stripped nuclear emulsions Ilford G5, 600 μ thick, 4″ × 6″ flown at 80,000 ft. These events seem to be of the same type as the one described recently by Schein. The common feature of these events is that the whole picture consists of very energetic pairs of charged particles (presumably pairs of electrons), and no other charged track or prong is observed in the neighborhood. The number of these pairs is rapidly increasing on a path of the order of few cm. The half cone enclosing all the tracks is of about 10^{-3} rad. In both cases the point of production of the first pair is inside the emulsion. A special scanning is being made in the backward direction. (auth)

MOLECULAR PROPERTIES

1626

ELECTRONIC STRUCTURE OF GRAPHITE AND BORON NITRIDE. Kanetaka Ariyama and Shoichi Mase (Nagoya Univ., Japan). Progr. Theoret. Phys. (Japan) 12, 244-6 (1954) Aug.

NEUTRONS

1627

POLARIZATION OF THERMAL NEUTRONS BY "NON-CRYSTALLINE" FERROMAGNETS. Draško D. Jovanović. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 43-6(1953) Aug.

NUCLEAR PHYSICS

1628

A GENERAL THEORY OF MAGNETIC RESONANCE ABSORPTION. Ryogo Kubo (Univ. of Tokyo, Japan) and Kuzuhisa Tomita (Kyoto Univ., Japan). J. Phys. Soc. Japan 9, 888-919(1954) Nov.-Dec.

A general expression for the frequency-dependent susceptibility of a magnetic system is derived by a quantum-statistical method based on the linear theory of irreversible processes. This fundamental equation provides a physical basis for the so-called Fourier transform method for computing the resonance line contour. The auto-correlation function, or the relaxation function of the magnetic moment that is the Fourier transform of the absorption intensity distribution, can be expanded in terms of the perturbation energy which is assumed to be responsible for changes of the resonance spectrum from the unperturbed distribution. A general method is developed for choosing from the expansion terms those which contribute to a particular line of interest. This is a generalization of the method of using projection operators. The customary moment method is examined from this point of view. Introducing a further assumption, a method is proposed for computing the contour of resonance lines from the obtained expansion. This may be regarded as the quantum-mechanical formulation of the idea employed by Anderson and Weiss for the exchange narrowing problem of paramagnetic resonance. The problem of motional effect on the broadening is treated from this general point of view. Particular applications of the theory to the motional effect of the dipolar broadening in nuclear magnetic resonance and to the exchange effect in paramagnetic cases are also discussed in detail. Some basic equations such as used by Bloembergen, Purcell and Pound for nuclear magnetic case are reexamined and corrected. (auth)

1629

NOTE ON THE STOCHASTIC THEORY OF RESONANCE ABSORPTION. Ryogo Kubo (Univ. of Tokyo, Japan). J. Phys. Soc. Japan 9, 935-44(1954) Nov.-Dec.

The stochastic theory of magnetic resonance absorption developed recently by P. W. Anderson is examined in some detail. The fundamental idea of the theory is that the resonating units suffer transitions among their possible states each of which is characterized by a proper frequency of the magnetic moment. The transition is assumed to be described by a Markoffian process. The fundamental equation for the auto-moment or the auto-correlation of the magnetic moment is rederived and transformed. Some general properties of the absorption spectrum are discussed on the basis of this equation. In particular, the narrowed spectrum for the case of rapid transition is proven to be Lorentzian with a half width determined by the equilibrium distribution of the units and the transition matrix of the Markoffian jumps. If the relaxation time of the transition is assumed to be completely degenerate, the resonance spectrum is given by

$$I(\omega) = \frac{1}{\pi} \mathrm{Re} \int \frac{P(\omega')d\omega'}{\omega_e + i(\omega-\omega')} \Big/ \left\{ 1 - \int \frac{\omega_e P(\omega')d\omega'}{\omega_e + i(\omega-\omega')} \right\}$$

were $P(\omega)$ is the intensity distribution in the limit of slow relaxation, $1/\omega_e$ being the relaxation time. Although this idealization is not quite physical, the result is useful for qualitative understanding of the changes in line shapes due to the motional effect. The limit of the Gaussian-Markoff case is also discussed. (auth)

1630

MESON PRODUCTION IN MESON-NUCLEON COLLISIONS. Yoshihiko Miyachi (Research Inst. for Theoretical Physics, Takeharamachi, Kamogun, Hiroshimaken, Japan). Progr. Theoret. Phys. (Japan) 12, 243-4(1954) Aug.

Fundamental differences in the interaction of π mesons with nucleons according to pseudoscalar or pseudovector couplings are investigated. Theoretical calculations are made for the $\pi^- + p \to \pi^- + \pi^+ + n$ process with the assumptions that meson-nucleon coupling is stronger than meson-meson coupling, and that the nucleons can be treated non-relativistically. It is shown that the measurement of π^+ meson production by π^- mesons on protons serves as a direct test of the nature of the meson-nucleon interaction. (K. S.)

1631

ELECTRON TRIDENTS BETWEEN 0.1 AND 10 BEV. M. M. Block, D. T. King, and W. W. Wada (Naval Research Lab., Washington, D. C.). Phys. Rev. 96, 1627-34(1954) Dec. 15.

Data on the direct production of pairs by fast electrons of cosmic radiation have been collected in nuclear emulsions by a track-following method. Multiple-scattering measurements were made on the secondaries of 61 tridents with energies between 0.1 and 10 bev; of these, 14 originated on arms of pairs. A mean free path of 134 ± 42 cm was deduced for the latter, corresponding to a cross section of $0.92 \pm 0.29 \times 10^{-25}$ cm^2. An appropriate statistical treatment for small numbers has been adopted, and a correction has been made for the inclusion of pseudo-tridents. The theoretical cross sections of Bhabha and Racah, which apparently disagree by a factor of about 2 in this energy region, have been shown to be consistent. The theoretical cross section averaged over the experimental energy distribution is 0.82×10^{-25} cm^2. The distributions in fractional energy transfer to the created pair and internal energy partition in the pair have been derived and are compared with our observations. It is concluded that trident theory is in agreement with this experiment. (auth)

NUCLEAR PROPERTIES

1632

ABSORPTION CROSS SECTION OF BORON FOR THERMAL NEUTRONS. G. von Dardel and N. G. Sjöstrand (AB Atomenergi, Stockholm, Sweden). Phys. Rev. 96, 1566-7 (1954) Dec. 15.

The thermal neutron absorption cross section of boron of different origin has been determined by comparing the decay of the neutron flux from a water solution of the sample with the flux decay from the same volume of distilled water. The ratio of the two decay curves is a pure exponential, independent of slowing down and of the presence of harmonic modes. After application of small corrections the decay constant of the ratio curve gives directly the absorption cross section. The result for the Argonne-Brookhaven standard boron is 764 ± 3 barns as compared to 755 ± 5, 749 ± 4, and 771 ± 5 barns obtained at Argonne, Brookhaven, and Harwell, respectively. (auth)

1633

LOW-LYING 1– STATES IN EVEN-EVEN NUCLEI. Frank Stephens, Jr., Frank Asaro, and I. Perlman (Univ. of California, Berkeley). Phys. Rev. 96, 1568-72(1954) Dec. 15.

In a limited isotopic region, there have been found low-lying states in even-even nuclei of spin 1, odd parity. Other energy levels in the vicinity are the well characterized 0 +, 2 +, and 4 + states of the even-even nuclear type. The 1– states were identified through α-γ angular correlation measurements supported by internal conversion coefficient data. (auth)

1634

NUCLEAR FINE STRUCTURE IN THE μ-MESONIC ATOM. Boris A. Jacobsohn (Univ. of Washington, Seattle). Phys. Rev. 96, 1637-43(1954) Dec. 15.

The 2p–1s transition of a μ-mesonic atom is split not only by the spin-orbit energy but also by the electric quadrupole interaction between meson and nucleus. If a high-Z nucleus has excited states at several hundred kilovolts or less this interaction can be expected to mix nuclear states, so that for example an even-even nucleus with ground state spin zero can produce a quadrupole fine structure. General formulas are given for the calculation of the line patterns; these are worked out for W, U^{238}, and Ta^{181}. The resulting fine structure is spread over a region of 300–500 kev. The details of the positions and intensities of the lines depend on the quadrupole moments of the excited nuclear states as well as on other parameters which can in principle be measured in other types of experiments; the effect therefore offers a method for investigating these excited moments. A certain fraction of the mesonic gamma rays can be followed by a nuclear radiation; this fraction can be as high as 0.50. (auth)

1635

FURTHER CONSIDERATIONS ON NUCLEAR POLARIZATION BY MEANS OF ELECTRON RESONANCE SATURATION. P. Brovetto and G. Cini (Istituto Nazionale di Fisica Nucleare, Torin, Italy). Nuovo cimento (9) 12, 899-904(1954) Dec. (In English)

The Overhauser effect is used as a technique to obtain high nuclear polarization. (auth)

1636

EFFECT OF CHEMICAL SHIFT AND J-COUPLING ON NUCLEAR RESONANCE LINE-SHAPE. M. K. Banerjee, T. P. Das, and A. K. Saha (Institute of Nuclear Physics, Calcutta, India). Proc. Roy. Soc. (London) A226, 490-509 (1954) Dec. 7.

The splitting up of nuclear resonance lines due to J coupling has been dealt with in detail for both the cases $J \sim \delta$ and $J \ll \delta$. It is shown that for $J \sim \delta$, appreciable departures occur from Gutowsky's rule in both the intensities and frequencies of the components, particularly the former. The exact line patterns in several important cases are given. (auth)

1637

A NEW HOME FOR NUCLEAR MATTER. T. H. R. Skyrme (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A226, 521-30(1954) Dec. 7.

The different values obtained for nuclear radii from electromagnetic interactions as compared with specifically nuclear interactions suggest a model of nuclear matter in which the meson field is supposed to condense into an incompressible fluid and the nucleonic sources are confined to its interior by a strong interaction between the sources and the fluid as a whole. The sources are also coupled to spin and charge fluctuations in the fluid, whose exchange leads to further internucleonic forces. It is necessary to postulate that the fluid have a comparatively low density; as a result rotational levels of the fluid are high, leading to a small probability of exchange of angular momentum (and charge coupled to it) with the sources. The values of the anomalous electrical interactions of nucleons deduced are in rough agreement with the facts. The nuclear structure indicated is a shell model embedded in the mesic fluid whose oscillations strongly coupled to the nucleons, give rise to the collective features of nuclear structure as in the theory of Bohr & Mottelson. It is suggested that this picture of the mesic field may indicate where to look for solutions of the meson field equations. (auth)

1638

ON THE EXCITED STATES OF EVEN-EVEN NUCLEI. Masayuki Nagasaki and Taro Tamura (Tokyo Univ. of Education, Japan). Progr. Theoret. Phys. (Japan) 12, 248-50(1954) Aug.

New data on the spins and parities of even-even nuclei are reviewed, showing a marked magic number dependence of excitation energies in the second excited states. (K. S.)

1639

NUCLEAR RESONANCE AND MOLECULAR MOTION IN FLUIDS. E. M. Purcell (Harvard Univ.). J. phys. radium 15, 785-90(1954) Dec. (In French)

The results of experiments are given which demonstrate the effect of pressure on the relaxation time of proton nuclear resonance in liquids. The measurements were made up to several thousand atmospheres. The results obtained cannot be interpreted by a variation of the coefficient of viscosity or diffusion as a function of pressure. The latter quantities depend essentially on the degrees of freedom of translation of the molecules of the liquid, whereas the relaxation time depends just as strongly on the rotation of the molecules. (tr-auth)

1640

REMARKS ON THE SHELL STRUCTURE AND NUCLEI OF ATOMS. R. Daudel, S. Odiot, and H. Brion (Institut du Radium et Institut de Méchanique ondulatoire appliquée à la Chimie et a la Radioactivité). J. phys. radium 15, 805-9 (1954) Dec. (In French)

It has not been possible until recently to introduce the notion of shells in the theory of particle systems without neglecting an important part of the correlation between the particle positions. A procedure is described which permits the association of certain space domains with the energy levels of a system. The method is rigorously applicable to the wave function. It is therefore possible to speak of levels without neglecting a single part of the previously mentioned correlation. Interesting conclusions are obtained on the localizability of particles in the shells and nuclei which permit a derivation, by geometric models, of the results by wave mechanics without contradicting the basic principles. (tr-auth)

NUCLEAR REACTORS

1641

Oak Ridge National Lab.
DETERMINATION OF THE POWER OF THE SHIELD-TESTING REACTOR. 1. NEUTRON FLUX MEASUREMENTS IN THE WATER-REFLECTED REACTOR. J. L. Meem and E. B. Johnson. Aug. 13, 1951. Decl. Nov. 8, 1954. Contract W-7405-eng-26. (ORNL-1027)

The procedure for calibrating the power and neutron flux of the Shield Testing Reactor is described. Flux determinations were made by exposing gold foils at enough points to gain a general knowledge of the flux patterns throughout the reactor. The fluxes at the points not measured were determined graphically taking advantage of symmetry. Data are presented for the fuel assembly arrangement in the second critical experiment. (M.P.G.)

1642

REDUCING NUCLEAR POWER COSTS. James A. Lane (Oak Ridge National Lab., Tenn.). Nucleonics 13, No. 1, 24-7(1955) Jan.

Capital and power cost factors in nuclear and coal-fired 200 Mw power plants are compared. The homogeneous thermal breeder reactor is used as an example. Fuel costs in a nuclear plant are computed. It is shown that estimated power costs can vary by a factor of 4 or more due to normal design variables and accounting procedures. It is concluded that most of the conditions for competitive nuclear power will not be too difficult to achieve within 10 yr. The most difficult task is the reduction of capital costs, the successful solution of which depends mainly on the establishment of a competitive nuclear power equipment industry to supplement the government-sponsored program. (M.P.G.)

1643

NUCLEAR REACTORS FOR INDUSTRY AND UNIVERSITIES. Ernest H. Wakefield, Ed. Pittsburgh, Instruments Publishing Co., 1954. 94p.

This volume contains a descriptive approach to the analysis of basic problems confronted by private industry and universities planning to construct nuclear reactors for research purposes. Attention is given to factors which affect the selection of reactor type, radiation protection, and reactor control and instrumentation. Chapters on cost analysis and the legal aspects of reactor operation are of particular interest, although the latter is based upon the Atomic Energy Act of 1946. (K.S.)

NUCLEAR TRANSFORMATION

1644

Radiation Lab., Univ. of Calif., Berkeley
ANALYSIS OF THE DISINTEGRATION PRODUCTS FROM

THE REACTIONS OF 125-MEV DEUTERONS WITH LITHIUM NUCLEI (thesis). Francis C. Gilbert. Oct. 15, 1954. 65p. Contract W-7405-eng-48. (UCRL-2771)

A thin lithium target (92.5% Li^7, 7.5% Li^6) was bombarded with the internal deuteron beam of the 184-inch cyclotron. The resulting fragments were detected in a row of nuclear track plates placed along a radial line from the target. An analysis of the tracks in the emulsions yielded the following information: (a) energy distributions for the production of various fragments from 0° to 70° from the beam direction; (b) the angular distribution of Li^8 nuclei in the reaction $H^2 + Li^7 \rightarrow H^1 + Li^8$; (c) the range distribution of the alpha particles following the decays of Li^8 and B^8; (d) the electron pickup by Li^8 ions as a function of their velocity; (e) the range of Li^8 nuclei in emulsion. In addition, absolute cross sections were obtained for processes (a) and (b) by means of exposures in the monitored external beam of the cyclotron. (auth)

1645

Radiation Lab., Univ. of Calif., Berkeley

THE MECHANISM OF THE REACTION $C^{12} + p \rightarrow p + 3\alpha$ AT 32 MEV (thesis). John Logan Need. Dec. 3, 1954. 65p. Contract W-7405-eng-48. (UCRL-2806)

A methane-filled expansion cloud chamber, operated at ⅓ atmosphere, was used to study the $C^{12} + p \rightarrow p + 3\alpha$ reaction. Two hundred events that satisfied momentum and energy conservation were accepted for analysis. One hundred forty-eight of these had all four prongs visible; the remaining fifty-two had only three visible prongs with the fourth prong directed into an invisible region of the chamber. There is no evidence for direct four-particle decay of N^{13*}. One-quarter of the events proceeded via the Be^8 ground state and at least one-half via the 2.9-Mev level in Be^{8*}; possibly higher levels in Be^8 were also involved. Evidence for the participation of levels in C^{12} at 9.6, 11.8, 16, 20, and 25 Mev was found. There are grounds for believing that the C^{12} (p,α) B^9 reaction also participates with evidence for levels at 0 and 3.2 ± 1.0 Mev. The possibility of the $C^{12} + p \rightarrow Li^5 + Be^8$ reaction was investigated, and it was concluded that it could account for at most 5% of the events. (auth)

1646

ANGULAR DISTRIBUTIONS OF α PARTICLES FROM THE $Na^{23}(p,\alpha)Ne^{20}$ REACTION. P. H. Stelson (Oak Ridge National Lab., Tenn.). Phys. Rev. 96, 1584-90(1954) Dec. 15.

The angular distribution of α particles produced by the $Na^{23}(p,\alpha)Ne^{20}$ reaction and leading to the ground state of the residual Ne^{20} nucleus has been measured at six resonances occurring in the region E_p = 1 to 2 Mev. The measured distributions are compared to the calculated angular distributions. In many cases the calculated angular distribution for a given type of compound state is not unique in that an unknown mixture of channel spins enters as well as possible admixtures of higher l values. The best assignments for the resonances at 1.137, 1.012, and 1.166 Mev are respectively 0^+, 3^-, and 2^+. A large anisotropy is observed for the resonance at 1.288 Mev which is not predicted by any simple assignment. It can, however, be fitted by a 1^- assignment in which there is a rather large admixture of *f*-wave to the p-wave protons. The resonance at 1.804 Mev is found to be complex. (auth)

1647

PROTON POLARIZATION IN (d,p) REACTIONS. W. B. Cheston (Univ. of Minnesota, Minneapolis). Phys. Rev. 96, 1590-2(1954) Dec. 15.

The polarization of the proton produced in a (d,p) reaction is calculated under the assumption that "stripping" is the primary mechanism operative. The model adopted for the polarization production consists in a proton-nucleus interaction potential of the spin-orbit type which has been successful in describing polarization effects in neutron scattering. The model is applied to the specific reaction $C^{12}(d,p)C^{13}$ for E_d = 3.29 Mev. (auth)

1648

EXCITATION FUNCTIONS FOR NITROGEN-INDUCED NUCLEAR REACTIONS IN CARBON. H. L. Reynolds and A. Zucker (Oak Ridge National Lab., Tenn.). Phys. Rev. 96, 1615-16(1954) Dec. 15.

The excitation functions for the reactions $C^{12}(N^{14},2p)Na^{24}$, $C^{12}(N^{14},\alpha)Na^{22}$, and $C^{12}(N^{14},2\alpha)F^{18}$ were measured with the external 29-Mev nitrogen beam of the 63-inch cyclotron. Thick-target yields as a function of energy were differentiated to obtain absolute cross sections from 16 to 29 Mev. A similarity to the excitation functions for reactions produced by protons on Mg^{25} is suggested. (auth)

1649

COMPARISON OF NITROGEN- AND PROTON-INDUCED NUCLEAR REACTIONS. B. L. Cohen, H. L. Reynolds, and A. Zucker (Oak Ridge National Lab., Tenn.). Phys. Rev. 96, 1617-20(1954) Dec. 15.

Excitation functions for (p,2p), (p,α), and (p,2α) reactions on Mg^{25} were measured with the internal 22-Mev proton beam of the 86-inch cyclotron. The results are compared with the excitation functions obtained for the reactions produced by 29-Mev nitrogen ions on carbon in the 63-inch cyclotron. Both sets of reactions may proceed via the same compound nucleus, Al^{26}. After corrections for the barrier penetrations of the incident particles, the (N,2p) and (p,2p) results are quite comparable. The corrected (N,α) and (N,2α) cross sections are larger than those for the corresponding proton-induced reactions by factors of about two and four respectively, indicating that processes other than conventional compound nucleus formation are involved in these nitrogen-induced reactions. The shape of the excitation functions for the nitrogen-induced reactions indicates that the protons and alpha particles are emitted from nearly spherical nuclei with charge equal to that of the compound nucleus; direct interactions such as stripping are thus excluded. (auth)

1650

ACTIVATION ANALYSIS WITH A $POLONIUM^{210}$ ALPHA SOURCE. Erik Odeblad (Karolinska Inst., Stockholm, Sweden). Acta Radiol. 42, 391-7(1954) Nov.

A 160-mc Po^{210} source was used for alpha particle activation of pure chemical compounds and biologic material. The stable isotopes it was found possible to activate to radionuclides in any appreciable extent were B^{10}, F^{19}, Na^{23}, Mg^{25}, and Al^{27}, giving N^{13}, Na^{22}, Al^{26}, Al^{28}, and P^{30}, respectively. The isotopic yields were between 0.2 and 2.2 per 10^6 alphas. Two biologic applications were studied: the measurement of Na in urine and the resorption of Al from the peritoneal cavity. (auth)

1651

PRELIMINARY NOTE ON THE ANGULAR DISTRIBUTION FROM $Be^9(d,t)Be^8$. Mira K. Jurić and Božidar S.

Maršičanin. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 139-40(1953) Aug.

PARTICLE ACCELERATORS

1652

[European Council for Nuclear Research]
FONCTIONNEMENT EN IMPULSION DE L'AIMANT MODELE AC III B. (Pulsed Operation of the Magnet Model AC III B). Nov. 1954. 24p. (CERN-PS/MM-8)

Initial magnet field measurements are reported for the AC III B test magnet of the CERN proton synchrotron when excited by an alternating current. The experimental equipment is described together with dynamic and static measurements. (K.S.)

1653

Rochester Univ.
PRELIMINARY REPORT ON THE NEW 8 MEV VARIABLE ENERGY CYCLOTRON OF THE UNIVERSITY OF ROCHESTER. H. W. Fulbright, D. A. Bromley, J. A. Bruner, R. Hawrylak, and A. Hamann. Nov. 12, 1954. 6p. Contract AT(30-1)-875. (NYO-6541)

The small cyclotron (7.5-Mev protons) of the Univ. of Rochester has recently been rebuilt in a new location within 3-ft thick shielding walls made of limonite concrete. The new design allows for adjustment of the oscillator frequency continuously over the range from 10 Mc to 22 Mc, hence the energy of the deflected proton beam can be varied continuously from 2 to 7.5 Mev, and the change to deuteron or α-particle operation is easily achieved. It is, of course, necessary to retune the magnet to resonance after each oscillator frequency change. The external beam handling scheme employed was designed for modern low-energy nuclear scattering and reaction studies. (auth)

1654

CERTAIN AUXILIARY INSTRUMENTS OF THE 1.5 MEV ACCELERATOR. Božidar S. Maršičanin and Miodrag D. Rakic. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 103-9(1953) Aug.

Various auxiliary instruments of a 1.5-Mev Cockcroft-Walton accelerator are described, including servosystem for beam stabilization, magnetic analyzer, and current integrator. (L.T.W.)

RADIATION ABSORPTION AND SCATTERING

1655

Knolls Atomic Power Lab.
THE ABSORPTION OF NEUTRONS IN DOPPLER BROADENED RESONANCES. G[lenn] M. Roe. Oct. 15, 1954. 85p. Contract W-31-109-Eng-52. (KAPL-1241)

A method is developed for the calculation of the effect of Doppler broadening on the absorption of neutrons by a resonance absorber. Numerical values are given for the correction factors required in the interpretation of transmission experiments and self-indication experiments and for the self-shielding factors for slabs, spheres, cylinders, and homogeneous mixtures. (auth)

1656

[Westinghouse Atomic Power Div.]
PENETRATION OF 6 MEV GAMMA RAYS IN LEAD AND IRON. K. Shure, P. A. Roys, and J. J. Taylor. Mar. 1954. 11p. Contract [AT-11-1-GEN-14]. (WAPD-T-170)

The broad beam attenuation characteristics of plane slabs of Pb and Fe for high-energy ($\sim$ 6 Mev) gamma rays have been determined experimentally. Measurements of the relative dose rate have been taken in air and in water through Pb thicknesses varying in 1-in. steps from 0 to 8 inches and through Fe thicknesses from 0 to 12 inches. The preliminary results permit comparison with recent theoretical calculations of gamma-ray penetration. (auth)

1657

PERTURBATION CALCULATION OF THE ELASTIC SCATTERING OF ELECTRONS BY HYDROGEN ATOMS. Sidney Borowitz (New York Univ., University Heights). Phys. Rev. 96, 1523-30(1954) Dec. 15.

A perturbation calculation has been carried out for the scattering of electrons by hydrogen atoms, using as the perturbation only the interaction between the two electrons, and retaining in the result only terms of the highest power in the incident energy of the electron. The results are then compared with more conventional first-order perturbation calculations for this problem. It is found that to the order in the energy that we retain, the results for direct-scattered amplitudes obtained by the two perturbation precedures are the same, whereas in the results for the exchange-scattered amplitudes there is a difference in the energy dependence. While no conclusions can be drawn as to which perturbation procedure is more accurate, some reasons are given for preferring the calculation performed. (auth)

1658

STERN-GERLACH EXPERIMENT ON POLARIZED NEUTRONS. J. E. Sherwood, T. E. Stephenson, and Seymour Bernstein (Oak Ridge National Lab., Tenn.). Phys. Rev. 96, 1546-8(1954) Dec. 15.

A neutron beam was polarized by total reflection from a magnetized iron mirror. The beam was then analyzed by passing it through an inhomogeneous magnetic field. From the deflection pattern obtained, it is inferred that the resultant neutron spin in the polarized beam was parallel to the magnetic field applied to the mirror. Thus the nuclear and magnetic scattering amplitudes for iron are of the same sign when the neutron spin and electronic spin are oppositely directed, and conversely. (auth)

1659

COMPARISON OF H^3 AND He^3 PRODUCTION IN HIGH-ENERGY DEUTERON-DEUTERON COLLISIONS. Charles S. Godfrey (Univ. of California, Berkeley). Phys. Rev. 96, 1621-7(1954) Dec. 15.

The relative production of H^3 and He^3 from deuteron-deuteron collisions at 190 Mev has been measured at 30° (center of mass). The method of detection required that the particles traverse a magnetic channel and a pulse-height counter telescope. The pulses were displayed on a fast cathode-ray oscilloscope and recorded photographically. A liquid deuterium target was employed. The comparison shows a ratio of H^3 to He^3 of 0.86 ± 0.14. These data support the hypothesis that charge symmetry of nuclear forces exists at high energy. (auth)

1660

POSSIBLE TRIPLE-SCATTERING EXPERIMENTS. L. Wolfenstein (Carnegie Inst. of Tech., Pittsburgh, Penna.). Phys. Rev. 96, 1654-8(1954) Dec. 15.

Triple-scattering experiments may be used to get additional information about the spin-dependence of the scattering matrix of the second scatterer. In general two new parameters describing the scattering may be determined by means of two distinct experiments, one in which the successive scattering planes are parallel and one in which the successive scattering planes are at right angles to each other. The relation between these parameters and the scattering matrix is given for the cases of protons scattered from a spin-zero target and of proton-proton scattering. For the former case the magnitude of the left-right asymmetry in the third scattering is calculated on the basis of a phenomenological model due to Fermi in the Born approximation. Further experimental possibilities for p-p scattering are discussed. (auth)

1661

NUCLEON-ANTINUCLEON SCATTERING AND VACUUM POLARIZATION. Kenneth A. Johnson (Harvard Univ., Cambridge, Mass.). Phys. Rev. 96, 1659-60(1954) Dec. 15.

The cross section for nucleon-antinucleon scattering is calculated by using the covariant form of the two-body equation in a simple approximation. The meson Green's function used is corrected for the first order radiative effects. The resulting S matrix is shown to be unitary. The cross section is nearly independent of the coupling constant. A graph is included. (auth)

1662

FOURTH ORDER CORRECTIONS TO MESON-NUCLEON SCATTERING IN PSEUDOSCALAR MESON THEORY. H. W. Wyld, Jr. (Univ. of Chicago, Ill.). Phys. Rev. 96, 1661-78(1954) Dec. 15.

The low-energy S- and P-wave phase shifts for meson-nucleon scattering in the relativistic pseudoscalar coupling theory are calculated in perturbation theory to fourth order in the coupling constant. A comparison is made of the complete relativistic theory and the nonrelativistic approximation to it, obtained by use of the Foldy-Wouthuysen transformation, via a comparison of the low-energy scattering predicted by both theories. It is concluded that the S-wave scattering is similar in the two theories but that the P-wave scattering is very different in the two theories in fourth order. An analysis of the sources of the differences between the two theories is made by calculating the fourth order scattering in a version of the relativistic theory in which all effects due to the production of pairs are eliminated. An investigation is made of the nature and possible validity of the Tamm-Dancoff approximation. Two possible viewpoints with respect to this approximation are developed, and the extent to which the Tamm-Dancoff method is applicable to the pseudoscalar coupling theory according to these two points of view is determined, insofar as the low-energy calculations of this paper allow. (auth)

1663

COULOMB INTERFERENCE EFFECTS IN PROTON-PROTON SCATTERING. A. Garren (Carnegie Inst. of Tech., Pittsburgh, Penna.). Phys. Rev. 96, 1709-10(1954) Dec. 15.

Calculations have been made of Coulomb interference effects at 200 Mev on the assumption that only s and p waves enter into the interaction. (L.T.W.)

1664

HIGH-ENERGY ELECTRON PAIR PRODUCED BY 113-MEV POSITIVE PION. Jay Orear, R. G. Glasser, D. M. Haskin, and Marcel Schein (Univ. of Chicago, Ill.). Phys. Rev. 96, 1710-11(1954) Dec. 15.

A high energy electron pair produced in a nuclear emulsion exposed to a 113-Mev positive pion beam is reported. The energies of the two electrons are 27 ± 9 and 56 ± 14 Mev. (L.T.W.)

1665

ON THE VELOCITY ANALYSIS OF ELECTRONS SCATTERED BY THIN FOILS. Hiroschi Watanabe (Hitachi Central Research Lab., Kokubunji-machi, Kitatama-gun, Tokyo, Japan). J. Phys. Soc. Japan 9, 920-8(1954) Nov.-Dec.

Results of measurement on the energy loss of 22 kev electrons after passing through various substances—metals, metal oxides, NaCl, $Ca(OH)_2$ and collodion—are given. The apparatus used was an electron velocity analyzer of Möllenstedt type. The design and construction of the analyzer is briefly described and some discussions are given on the results obtained. (auth)

1666

THE EFFECTS OF HEAVY PARTICLES ON π-MESON-PROTON SCATTERING. Shigeaki Hatano, Tadashi Kaneno, and Mitsuo Shindo (Kyoto Univ., Japan). Progr. Theoret. Phys. (Japan) 12, 167-76(1954) Aug.

Recent experimental results on total π^--p scattering cross sections show that the broad second maximum exists at about 900 Mev. This high-energy region lies above the threshold of the production of heavy particles, so that the radiative corrections due to heavy unstable particles to pion-nucleon scattering would be fairly large, as suggested by Yang, since the intermediate state exists in which the energy-momentum conservation holds. The radiative corrections due to heavy particles to π^--p scattering are calculated. Assuming the Λ particle is a spin $\frac{1}{2}$ particle with isotopic spin 0 or 1 and the θ particle is a spin 0 or 1 particle with isotopic spin $\frac{1}{2}$, and introducing interactions (π N N), (θ Λ N) and (π Λ Λ) which are considered as strong interactions by the even-odd rules, the fourth order perturbational calculations are carried out. The results are as follows: (1) SE type S(S) corrections are larger at lower energies and they do not seem to be able to make the cross section larger in the high energy region; (2) SE type V(V) corrections have more desirable tendencies than in the S(S) case, yet they make only the cross section flat at the high energy end; (3) V type S(S) corrections possibly raise the cross section to be compared with the experimental values; (4) Considering that the radiative corrections due to heavy particles from π^--p scattering are rather large, we might conclude that it gives support to the validity of the charge independence for heavy unstable particles. (auth)

1667

NUCLEAR COLLISIONS OF HIGH ENERGY PROTONS, MESONS AND α-PARTICLES. A. Engler, U. Haber-Schaim, and W. Winkler (Physikalisches Institut der Universität, Bern, Switzerland). Nuovo cimento (9) 12, 930-42(1954) Dec. (In English)

The results of a systematic scanning of nuclear emulsions flown at high altitude are presented and analyzed. It is found that at high energies the size of the target nucleus is not of major importance with regard to the number of shower particles produced. Also, the multiplicity of mesons for α particles is about the same as for protons. The angular distribution of shower particles in the c.m. system is described and evidence is presented for the asymmetry of meson-nucleus collisions. Finally, the elasticity of nucleon-nucleus collisions is briefly discussed. (auth)

RADIATION EFFECTS

1668

EQUIVALENCE OF X-RAY LATTICE PARAMETER AND DENSITY CHANGES IN NEUTRON-IRRADIATED LiF. D. Binder and W. J. Sturm (Oak Ridge National Lab., Tenn.). Phys. Rev. 96, 1519-22(1954) Dec. 15.

The lattice expansion in neutron-irradiated LiF was investigated in order to establish either Frenkel or Schottky defects as the cause of the expansion. For uniformly irradiated crystals, it was shown that x-ray lattice parameter and density changes are equivalent to within 6 percent. It follows that Schottky defects cannot account for more than 6 percent of the expansion and that Frenkel defects are predominant. The annealing of a nonuniformly irradiated crystal indicates a recovery process of order higher than one. (auth)

RADIOACTIVITY

1669

Radiation Lab., Univ. of Calif., Berkeley
GAMMA RAY STUDIES ON THE DECAY CHAIN $Zr^{86} \rightarrow Y^{86} \rightarrow Sr^{86}$. E[arl] K. Hyde, M. G. Florence, and F[rank] S. Stephens. Dec. 10, 1954. 16p. Contract W-7405-eng-48. (UCRL-2813)

The 14.6 hr Y^{86} decays by positron emission with positron group maximum energies of 1.8 and ~1.19 Mev. The Sr^{86} level reached by the 1.8-Mev group deactivates to ground with a 180-kev, 1.93-Mev and 1.08-Mev γ cascade yielding an overall decay energy of 6.01 Mev. No crossover γ rays were observed. Zr^{86} decays by electron capture with a 17-hr half life to a 241-kev level in Y^{86} which deactivates to the ground state within 5×10^{-6} sec. There are no other γ rays in the decay of Zr^{86}. (auth)

1670

OPTICAL STUDIES OF RADIOACTIVE MERCURY. F. Bitter, S. P. Davis, B. Richter, and J. E. R. Young (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 96, 1531-9(1954) Dec. 15.

A technique has been developed for studying the hyperfine structure of the resonance radiation of mercury. A single Zeeman component of the 2536 A line of Hg^{198} is used as a variable-frequency monochromatic light source, and the field strength applied to the arc lamp to produce resonance absorption in a resonance lamp is a measure of the resonance frequency. Natural mercury and radioactive mercury produced by bombarding gold with 15-Mev deuterons were investigated in this way and also (by means of an echelle spectrograph) in the emission spectrum of an electrodeless discharge. Several observed lines have not been conclusively identified. The magnetic moment of Hg^{197} is 4 percent greater than that of Hg^{199}. The isotope shift of isotopes with even mass number decreases with decreasing mass number. This effect may be due in part to the increasing quadrupole moment with neutron deficiency in these isotopes. (auth)

1671

DECAY OF Pm^{150}. Vera Kistiakowsky Fischer (Univ. of California, Berkeley, and U. S. Naval Radiological Defense Lab., San Francisco). Phys. Rev. 96, 1549-53(1954) Dec. 15.

A grey wedge pulse height analyzer was used to study the decay of Pm^{150} with and without coincidence arrangements. Gamma rays 3.0, 2.6, 2.0, 1.67, 1.32, 1.17, 0.82, 0.43, and 0.34 Mev in energy were observed, some in coincidence with 2.01- and 3.00-Mev negatrons which had previously been shown to be emitted. A decay scheme is suggested and some remarks on the beta stability of Nd^{150} are made. (auth)

1672

K CAPTURE TO POSITRON RATIO FOR Na^{22}. W. E. Kreger (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). Phys. Rev. 96, 1554-5(1954) Dec. 15.

The ratio of electron capture to positron emission from Na^{22} to the 1.28-Mev excited state of Ne^{22} has been measured by determining the relative number of 1.28-Mev and 0.511-Mev gamma rays from this decay. The gamma-ray intensities were measured with a 4-in. by 5-in. NaI(Tl) scintillation spectrometer and a collimated geometry. Photopeak areas were determined for the two gamma-ray energies, and using photopeak to total areas previously determined and NaI absorption coefficients, the ratio of gamma-ray intensities was calculated. The results showed that 11.0 ± 0.9 percent of the disintegrations to the excited state of Ne^{22} are not accompanied by the emission of two 0.511-Mev quanta, and therefore decay by orbital electron capture. (auth)

1673

DECAY OF $_{32}Ge^{75m}$ (49 SEC), $_{32}Ge^{77m}$ (52 SEC), AND $_{32}Ge^{77}$ (12 HR). S. B. Burson, W. C. Jordon, and J. M. LeBlanc (Argonne National Lab., Lemont, Ill.). Phys. Rev. 96, 1555-62(1954) Dec. 15.

The investigations described have been carried out by using scintillation coincidence spectrometer and 180° focusing magnetic spectrographs. Sources are prepared by the activation of both normal germanium and the enriched isotopes thereof in the Argonne reactor (CP-3′). Three of the neutron-induced activities of germanium are studied. Ge^{75m} (49 sec): The half-life and isotopic assignment of the activity are confirmed. From internal-conversion measurements, the energy of the isomeric transition is found to be 138.5 ± 1.0 kev, and the K/L ratio estimated to be ~3. Ge^{77m} (52 sec): The isotopic assignment of the activity is confirmed and the half-life measured to be 52 ± 2 seconds. The isomeric state of Ge^{77} decays by three branches: an isomeric transition of 159 ± 3 kev to the ground state of Ge^{77}, an ~2.7-Mev beta ray to a 215 ± 3-kev excited state of As^{77}, and an ~2.9-Mev beta ray to the ground state. Ge^{77} (12 hr): From the scintillation spectrometer measurements, the presence of eighteen gamma rays is deduced. Though beta-gamma and gamma-gamma coincidence experiments these are incorporated into a decay scheme which includes the 52-second isomeric state of Ge^{77} and nine excited states of As^{77}. (auth)

1674

CAPTURE-POSITRON BRANCHING RATIOS. P. F. Zweifel (Knolls Atomic Power Lab., Schenectady, N. Y.). Phys. Rev. 96, 1572-5(1954) Dec. 15.

Expressions are given for allowed and first-forbidden K and L capture probabilities and rules are formulated for obtaining such expressions for capture of any order of forbiddenness from any orbit. The effect of screening on branching ratios is discussed, and a table for the rapid calculation of allowed branching ratios, including screening effects, is given. The results are then applied to the decays of Zn^{65}, Na^{22}, Sc^{44}, and V^{48}. (auth)

1675

DECAY OF $_{22}Ti^{51}$ (5.8 MIN). W. C. Jordan, S. B. Burson, and J. M. LeBlanc (Argonne National Lab., Lemont, Ill.). Phys. Rev. 96, 1582-3(1954) Dec. 15.

The radiations from Ti^{51} have been studied with a scintillation coincidence spectrometer. Gamma rays of 0.32, 0.61, and 0.92 Mev are resolved. Their intensities are estimated to be in the ratio 100:1:5, respectively. The 0.32- and 0.61-Mev gamma rays are in coincidence. Two beta-ray components are resolved; one of approximately 2.3 Mev is in coincidence with the 0.32-Mev gamma ray, and one of 1.8 Mev is in coincidence with the 0.92-Mev radiation. No indication of a beta transition to the ground state of V^{51} is observed. (auth)

1676

BETA SPECTRUM OF RADIUM E. E. A. Plassmann and L. M. Langer (Indiana Univ., Bloomington). Phys. Rev. 96, 1593-8(1954) Dec. 15.

The beta spectrum of RaE (Bi^{210}) has been remeasured with improved techniques. The distribution is fitted by a shape factor appropriate to a once forbidden transition with a spin change, $\Delta J = 1$ involving interference between the S and T couplings. The experimental measurement is used to set limits on the ratio of the beta moments which are treated as parameters. (auth)

1677

DISINTEGRATION OF Ir^{192} AND Ir^{194}. M. W. Johns and S. V. Nablo (McMaster Univ., Hamilton, Ontario, Canada). Phys. Rev. 96, 1599-1607(1954) Dec. 15.

The energies and intensities of 20 gamma rays of Ir^{192} and 16 gamma rays of Ir^{194} have been measured by studying their external conversion spectra with a high resolution beta-ray spectrometer. A Fermi analysis of the beta spectrum of Ir^{194} reveals four components with the following end-points and intensities: 2236 kev (70 percent), 1905 kev (16 percent), 975 kev (9 percent), and 430 kev (2.8 percent). The observed beta and gamma radiations are consistently accounted for in terms of transitions to the following levels of Pt^{194}: 0.0, 328.1, 621, 1265, 1477, 1665, 1794, 1802, 1836, 1946, and 2048 kev. The $Ir^{194}-Pt^{194}$ energy difference is 2236 ± 10 kev. The Ir^{192} gamma-ray energies are classified in terms of levels at 0.0, 283, 485, 690, and 1064 kev in Os^{192} and 0.0, 316, 612, 784, 921, 1155, 1201, and 1359 kev in Pt^{192}. The results for Ir^{192} serve chiefly as confirmation of earlier investigations. (auth)

1678

INTERNAL CONVERSION IN He^{22}. R. D. Leamer and G. W. Hinman (Carnegie Inst. of Tech., Pittsburgh, Penna.). Phys. Rev. 96, 1607-9(1954) Dec. 15.

The internal conversion coefficient of the 1.28-Mev γ ray in Ne^{22} has been measured to determine its multipole character. It has been found to be E2. The spin and parity assignments to the Ne^{22} excited state and the Na^{22} ground state are discussed. (auth)

1679

K-ELECTRON EJECTION IN THE BETA DECAY OF S^{35}. William Rubinson and J. J. Howland, Jr. (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 96, 1610-13 (1954) Dec. 15.

By means of proportional-counter pulse-height analysis, it is found that S^{35} sources emit K photons of chlorine with a probability of $2.47(\pm 0.6) \times 10^{-4}$ photon/beta (the indicated error being an extreme), equivalent to a probability for K-hole production of $2.3(\pm 0.7) \times 10^{-3}$ K hole/beta. The theory, which has about the same accuracy as the experiments, predicts 3.0×10^{-3} K hole/beta. (auth)

1680

DECAY CHARACTERISTICS OF SOME SHORT-LIVED NUCLIDES OF LOW ATOMIC NUMBER. R. M. Kline and D. J. Zaffarano (Iowa State Coll., Ames). Phys. Rev. 96, 1620(1954) Dec. 15.

The short-lived activities in Cl^{34}, K^{38}, Ca^{39}, Li^{8}, He^{6}, and O^{15} formed by high-energy bremsstrahlung irradiation have been examined, and some improved values for the half lives of these nuclides are reported. (auth)

1681

LONG-LIVED RADIOACTIVE ALUMINUM 26. James R. Simanton, Robert A. Rightmire, Alton L. Long, and Truman P. Kohman (Carnegie Inst. of Tech., Pittsburgh, Penna.). Phys. Rev. 96, 1711-12(1954) Dec. 15.

The long-lived radioactive Al^{26} has been sought in Al carrier isolated from a target of commercial Mg bombarded with 400 μa-hr of 15-Mev deuterons. The radioactivities observed are consistent with a dominant mode of disintegration of Al^{26} by positron emission to the 1.83-Mev first excited state of Mg^{26}. (L.T.W.)

1682

ORBITAL ELECTRON EXCITATION ASSOCIATED WITH ELECTRON CAPTURE IN A^{37}. Max Wolfsberg (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 96, 1712-13 (1954) Dec. 15.

Miskel and Perlman (Phys. Rev. 94, 1683(1954)) have analyzed the pulse-height spectrum produced by the decay of A^{37}, which consists mainly of one peak centered at 2.83 kev. They interpreted the processes giving rise to pulses in the region between 5.4 and 9.7 kev as K-electron excitation and ejection accompanying K capture. In the present paper the magnitudes of two other processes which might give rise to a significant number of events in the energy interval considered are given. The two processes considered are L-electron excitation associated with K-electron capture and K-electron excitation accompanying L capture. (L.T.W.)

1683

COINCIDENCES BETWEEN β AND γ RAYS DETECTED WITH THE AID OF A β AND SCINTILLATION SPECTROMETER. APPLICATION TO THE STUDY OF THE DECAY SCHEME OF Sm^{153}. N. Marty (Collège de France). J. phys. radium 15, 60S-1S(1954) Dec. (In French)

1684

INTENSITY RELATIONSHIP OF γ -RAYS OF Xe^{131}. Anka M. Mijatović and Veljko Z. Wintersteiger. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 3, 57-9(1953) Aug.

The intensity relationship of γ rays is determined by the quantitative analysis of the γ spectrum in NaI (Tl). The results are well in accordance with the scheme proposed by Deutsch. The 722-kev transition is probably not a pure E2 transition but also partially M1. (auth)

1685

THE β^+ HALF LIFE OF V^{47}. H. Daniel (Max-Planck-Institut fur medizinische Forschung, Heidelberg, Germany). Z. Naturforsch. 9a, 974-5(1954) Nov.

In a magnetic spectrometer, only a simple β spectrum with 1.89 ± 0.01 Mev border energy was found, which led to the ground state of Ti^{47}. (tr-auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

1686

HYPERFINE STRUCTURE OF THE SPECTRA OF Nd AND

Gd. Kiyoshi Murakawa (Institute of Science and Technology, Tokyo, Japan). Phys. Rev. 96, 1543-6(1954) Dec. 15.

Study of the hyperfine structure of the spectrum of Nd II with separated isotopes yielded the result that the nuclear magnetic moments of the odd isotopes are $\mu(\mathrm{Nd}^{143}) = -1.1 \pm 0.1$ nm and $\mu(\mathrm{Nd}^{143}) = -0.69 \pm 0.10$ nm. The isotope shift in Nd I λ4924 was measured and the ratio of the distances of the neighboring isotopes was found to be $\Delta\nu(142-143) : \Delta\nu(143-144) : \Delta\nu(144-145) : \Delta\nu(145-146) : \Delta\nu(146-148) : \Delta\nu(148-150) = 0.4_0 : 0.5_7 : 0.2_0 : 0.7_3 : 1 : 1.5$. From the hyperfine structure of the spectrum of Gd I the nuclear spins of the odd isotopes Gd^{155} and Gd^{157} were found to be equal to or larger than $^5/_2$, the magnetic moments being negative. Under the assumption that the spins are equal to the values predicted by the nuclear shell structure theory, namely $^7/_2$, the magnetic moments were calculated to $\mu(\mathrm{Gd}^{155}) = -0.19 \pm 0.05$ nm and $\mu(\mathrm{Gd}^{157}) = -0.33 \pm 0.06$ nm. An anomalous isotope shift of the even isotopes of Gd was found: $\Delta\nu(160-158) : \Delta\nu(158-156) : \Delta\nu(156-154) : \Delta\nu(154-152) = 1 : 0.97 \pm 0.02 : 1.21 \pm 0.05 : 2.2 \pm 0.1$. (auth)

SPECTROSCOPY

1687

ENVIRONMENTAL EFFECT ON ATOMIC HYDROGEN HYPERFINE STRUCTURE IN ACIDS. Henry Zeldes and Ralph Livingston (Oak Ridge National Lab., Tenn.). Phys. Rev. 96, 1702(1954) Dec. 15.

Paramagnetic resonance absorption lines of atomic hydrogen have been observed in $\mathrm{HClO_4}$, $\mathrm{H_2SO_4}$, and $\mathrm{H_3PO_4}$ after irradiation with $\mathrm{Co^{60}}$ γ radiation at 77°K (Livingston, Zeldes, and Taylor (Phys. Rev. 94, 725(1954)). In the present paper a re-examination of some samples of the acids showing very intense lines reveal relatively weak satellite lines. (L.T.W.)

THEORETICAL PHYSICS

1688

Radiation Lab., Univ. of Calif., Berkeley
THE CONCEPT OF SETS ENCHAINED BY A STOCHASTIC PROCESS AND ITS USE IN CASCADE SHOWER THEORY (thesis). Bayard Rankin. July 1954. 69p. Contract W-7405-eng-48. (UCRL-2652)

Almost all solutions for the number distribution of electrons and photons in cascade result from one general methodology. These solutions (including those of Nordsieck, Lamb, Uhlenbeck, Scott, Bhabha, Ramakrishnan, Janossy, Messel, Potts, and one previously given by the author) are obtained by solving for the probability, or probability density, that the electron-photon system belongs to one or another of a set of states after it has penetrated x-units of absorbing material. This general method of approach is in contradistinction to the conceivable method of determining the probability weighting for each state individually. It has the advantage of entailing fewer parameters—just enough to specify the sets rather than the detailed configurations of states within these sets. It may have the disadvantage of leading to equations that are non-linear or otherwise difficult to solve, for the Markovian property of a cascade may be lost when the detailed description of a state is given up. In the present paper, the above methodology is investigated for stochastic processes in general, and it is shown how certain choices of sets can be made which preserve the linearity properties, though not necessarily the Markovian properties. It is then shown how in the particular case of a cascade shower these sets can be used to eliminate the need for low energy spatial parameter (those that describe the three-dimensional spreading of the shower at low energies) and also individual energy parameters for all particles. Only three parameters are retained, the number of electrons, the number of photons, and their total energy. These are enough to carry one directly to the number distribution by means of a linear function of exponentials. No matrices or integral transforms are needed, provided the assumptions of the previous paper are retained and the bremsstrahlung spectrum is idealized in the region of photon energies less than ϵ, $\epsilon > 0$. The elimination of the spatial parameters is done at some expense: The results refer only to the population of particles whose energies are above ϵ. The elimination of the individual energy parameters is dependent on an assumption: For the population of particles whose energies are above the detailed energy configuration of the particles is known and is independent of x when the number of particles present at x and their total energy are known. ϵ can be chosen as the critical energy. (auth)

1689

Radiation Lab., Univ. of Calif., Berkeley
THE VALIDITY OF THE ISOTOPIC SPIN QUANTUM NUMBER FOR LIGHT NUCLEI (thesis, Princeton Univ.). William M. MacDonald. Oct. 1954. 175p. Contract W-7405-eng-48. (UCRL-2746)

Violations of certain isotopic spin selection rules on nuclear reactions is attributed solely to the effect of the Coulomb potential in mixing states of different isotopic spin. It is shown that only the isotopic spin impurity arising through perturbation of the wave functions of nucleons in closed shells by their mutual interaction is important in nuclear states until quite high excitations are reached. Experimentally determined limits on isotopic spin impurity are easily explained by the presence of the Coulomb interaction. Formulas are derived for the exact quantum mechanical transition probabilities for radiation of any multipolarity. The isotopic spin selection rule on β-decay is studied. The effect of the isotopic spin impurity on the Fermi coupling constant derived from $0^+ \rightarrow 0^+$ transitions is shown to be just beyond the present limits of experimental accuracy. (M.P.G.)

1690

REDUCED WIDTHS ON COLLECTIVE MODEL. Shiro Yoshida (Univ. of Kyoto, Japan). Progr. Theoret. Phys. (Japan) 12, 141-55(1954) Aug.

The reduced width is calculated on the basis of the collective model. The two extreme approximations, weak and strong couplings, are adopted. The weak coupling approximation predicts its magnitude similar to but a little smaller than that predicted by the individual particle model. The strong coupling approximation predicts a very different value from that predicted by the single particle model. The case in which the compound nucleus has one or two particles outside the core is treated. It is shown that the experimental data of the reduced widths of light nuclei lie between those derived on the two extreme approximations. (auth)

1691

APPLICABILITY CRITERION OF THE THEORY OF STRONG COUPLING OF PARTICLES WITH MESON FIELDS. S. I. Pekar. Zhur. Ekspt'. i Teoret. Fiz. 27, 579-89(1954) Nov. (In Russian)

1692

INTEGRAL EQUATIONS FOR CASCADE SHOWERS. John M. Blatt (Univ. of Sydney, Australia). Phys. Rev. 96, 1644-50(1954) Dec. 15.

Integral equations of a new type are derived for the lateral and angular distribution functions in a cascade shower. The moment recursion relations of Nordheim are direct consequences of these integral equations. The method of derivation has some intrinsic interest since it involves the formal device of the introduction of negative probabilities for events in which nothing happens. This formal device may have applications in other fields. No solutions of the integral equations derived here are given in this note. (auth)

1693

NEW FORMULATION OF A GENERAL THREE-DIMENSIONAL CASCADE THEORY. B. A. Chartres and H. Messel (Univ. of Sydney, Australia). Phys. Rev. 96, 1651-4(1954) Dec. 15.

A new simple and straightforward formulation of a general three-dimensional cascade is given. The resultant integral equations include those derived by Blatt as a special case. The equations have a number of interesting features which distinguish them from those commonly used in cascade theory. They also lead to a simple moment recursion relation which is valid for all energies and which includes various processes such as Compton effect and ionization loss. The paper greatly simplifies previous work on the subject. (auth)

1694

RENORMALIZATION OF A NEUTRAL VECTOR MESON INTERACTION. R. J. N. Phillips (Cambridge Univ., England). Phys. Rev. 96, 1678-9(1954) Dec. 15.

A proof is given that the vector interaction of neutral vector mesons and fermions can be renormalized, to replace a fallacious proof by Matthews. A new interaction representation, formally different from the usual one, is used. The basic idea, not a new one, is that the objectionable part of the interaction can be identified with a certain scalar meson interaction, known to be illusory. (auth)

1695

MANY-PARAMETER WAVE FUNCTIONS IN THE INDEPENDENT-PARTICLE MODEL. Erwin H. Kronheimer (Birkbeck Coll., London, England). Phys. Rev. 96, 1680-2 (1954) Dec. 15.

It is shown that it is possible to introduce additional parameters into the single-particle wave functions used in estimating, by the Slater method, the lowest eigenvalue of a given Hamiltonian for an N-nucleon system, without altering the structure of the matrix elements. This is done by associating a different radial parameter with each shell of each N-particle wave function, subject to certain restrictions. The modification of the matrix elements is given. (auth)

1696

TAMM-DANCOFF METHODS AND NUCLEAR FORCES. Behram Kurşunoğlu (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 96, 1690-1701(1954) Dec. 15.

It is shown that by the use of 3-dimensional Feynman diagrams as equal-time two-particle wave equation can be written down. The procedure is the same one as Bethe and Salpeter used in deriving the 4-dimensional two-body equation. In this way all the terms of the new Tamm-Dancoff method of Dyson, in the form of the Lévy-Klein expansion of the interaction function, can easily be recorded. The connection between the Bethe-Salpeter and Dyson equations is discussed. The spurious energy denominators of the fourth order interaction, in the adiabatic limit, can be eliminated by including all the contributions to the fourth order term arising from the 4- and 5-particle amplitudes that are coupled back to the two-particle amplitudes. The potential derived in the adiabatic limit to the fourth order term of the interaction operator is the same as the Lévy-Klein potential derived from the old Tamm-Dancoff method. The Appendix contains a discussion of the Bethe-Salpeter equation and a simple method of derivation of equal-time equations from the 4-dimensional theories. (auth)

TRITIUM AND TRITIUM COMPOUNDS

1697

Los Alamos Scientific Lab.

THE PREPARATION OF A PRIMARY STANDARD OF TRITIUM WATER. John [D.] Farr and Dwayne T. Vier. Aug. 24, 1954. 6p. Contract W-7405-Eng-36. (LA-1734)

A primary standard of tritium water has been prepared by the reaction of tritium with copper oxide. The tritium water was diluted with ordinary water to give a tritium concentration of 19.55 ± 0.10 curies/liter. (auth)

1698

Institute for Nuclear Studies, Univ. of Chicago

NATURAL DISTRIBUTION OF COSMIC RAY PRODUCED TRITIUM II. Haro von Buttlar and W. F. Libby. Nov. 1954. 33p. Contract AF 18(600)-564. (OSR-TN-54-338)

The measurement of the abundance of T in natural waters has been continued during the last 18 months. The method used consists of the electrolytic concentration of the water samples, the measurement of the deuterium concentration in the final product from which the enrichment factor for any T present in the original samples can be calculated, followed by the determination of the T content of the concentrate by placing it as gaseous H in a Geiger counter. It is shown that the data are in agreement with an average cosmic ray production rate of about 0.14 T atoms per cm^2 per second of the earth's surface, on the assumption that essentially all of this T passes into water without decaying into He and the tritiated water is precipitated out and goes into the sea. The average T content of oceanic rain appears to be about 1 T atom per 10^{18} H atoms, whereas the continental rains have higher assays. The great Mississippi Valley shows about 6. The western coast of Europe runs about 2.5. Several hot springs have been tested and most found to be rain water. Tests on wells agreed with expectations. As yet there is no significant meteorological understanding of the erratic fluctuations in the T assays for rain in a given location. It probably is due to variation in air mass trajectories, orgins, and water contents. (auth)

URANIUM AND URANIUM COMPOUNDS

1699

[Atomic Energy Research Establishment, Harwell, Berks (England)]

THE THERMAL EXPANSION OF SINTERED UO_2. P. Murray and R. W. Thackray. [nd] 4p. (AERE-M/M-22)

The coefficient of thermal expansion of sintered UO_2 in A from 400 to 900°C was found to be 10×10^{-6}. The percentage linear expansion between 20°C and various temperatures up to 900°C are tabulated. The bulk density of the sintered specimen was found to have little effect on the thermal expansion. (J.A.G.)

1700

FISSION YIELD OF Gd^{159} AND Tb^{161}. Henry G. Petrow and Gregory Rocco (Tracerlab, Inc., Boston, Mass.). Phys. Rev. 96, 1614(1954) Dec. 15.

Normal uranium, irradiated with thermal neutrons, has been examined for the presence of Gd^{159} and Tb^{161}. Both isotopes were found and their fission yields measured. For purposes of calibration, the yields for Sm^{153} and Eu^{156} have also been determined. The chemical separations were made using a combination of ion exchange and extraction techniques. (auth)